TA
590
T8

$B 315 337

TURNER'S SKETCH BOOK

LIBRARY
OF THE
UNIVERSITY OF CALIFORNIA.

Class

TOPOGRAPHICAL

RECORD AND SKETCH BOOK

FOR USE WITH

TRANSIT AND STADIA

BY

DANIEL LAWRENCE TURNER, C. E.

Associate Member American Society Civil Engineers

Instructor in Surveying and Hydraulics, Harvard University.

LIBRARY OF THE UNIVERSITY OF CALIFORNIA

NEW YORK

THE ENGINEERING NEWS PUBLISHING COMPANY

1902

TA 590
T8

GENERAL

Copyright, 1901, by
THE ENGINEERING NEWS PUBLISHING COMPANY.

LIBRARY OF THE UNIVERSITY OF CALIFORNIA

INTRODUCTION.

This record and sketch book is the outcome of efforts in teaching students topographical surveying. Sketches are always desirable in this work; and, if properly made, the number of points necessary to develop any particular area is thereby reduced. To be most useful, sketches should be approximately to scale, and should clearly indicate the configuration of the area covered.

It is almost impossible for beginners in topography to make sketches that are of any value; and it is difficult in many cases for even the experienced topographer to do so.

A sketch book with concentric circle and radial rulings was first tried by the author in 1896. The results proved to be so satisfactory that in 1896 a book containing such rulings was printed for students in the author's classes, where it has since been used with gratifying results. Believing that such a book may also be appreciated by fellow teachers and by engineers and surveyors generally, it is with pleasure that it is now placed at their disposal.

The method of using the book is almost self-evident. The vertical rulings are of such form that they may be readily adapted to almost any method of recording. They are suitable for level notes, and also for the ordinary land survey and traverse records. The right-hand page can be used for any kind of sketching.

For topographical work the form of record shown on the next page is suggested.

205565

For stadia station sights—in addition to azimuths—fore and back magnetic bearings should be read and recorded. It is not necessary, however, to provide an extra column for recording these magnetic bearings. They can be noted down under the corresponding azimuth on an extra horizontal line. It is essential, though, that they be noted down, in order that they may serve as witnesses, should errors be afterwards discovered when plotting.

Remembering that in most cases it is only necessary

July 3., 1898.
Oc. ⊡ IV. Ele. 93.27 H. I. 4.70

Sta.	Az.	Dist.	Vert. L.	Diff. Ele.	Ele.	Remarks.
⊡ III	272°21'	~~692~~	+4°16'			B. S.
	N 87°35'W	688				
45	63°10'	1080	+6°07'			Saddle.
46	67°25'	830	+3°18'			Fr. Slope.
47	etc.	etc.	etc.			
⊡ V	82°19'	~~533~~	−3°12'			F. S.
	N 82°19'E	531				

to reduce to the horizontal the distances between stadia stations, such corrected distances may be noted under the distance read, in the same extra horizontal line previously used for the magnetic bearings.

With regard to the "side shots"—the sights taken to determine the position of the controlling points in the configuration—they should be numbered continuously through adjacent stadia stations, except when the total number taken at the several adjacent stations runs up into the thousands. If not numbered in this manner, two or more plotted shots may happen together on the sheet, and so cause confusion when interpolating

for contours. Also, such numbering saves time when it becomes necessary to look up the record in order to check the plotting. The azimuths of side shots need only be read to the nearest five minutes.

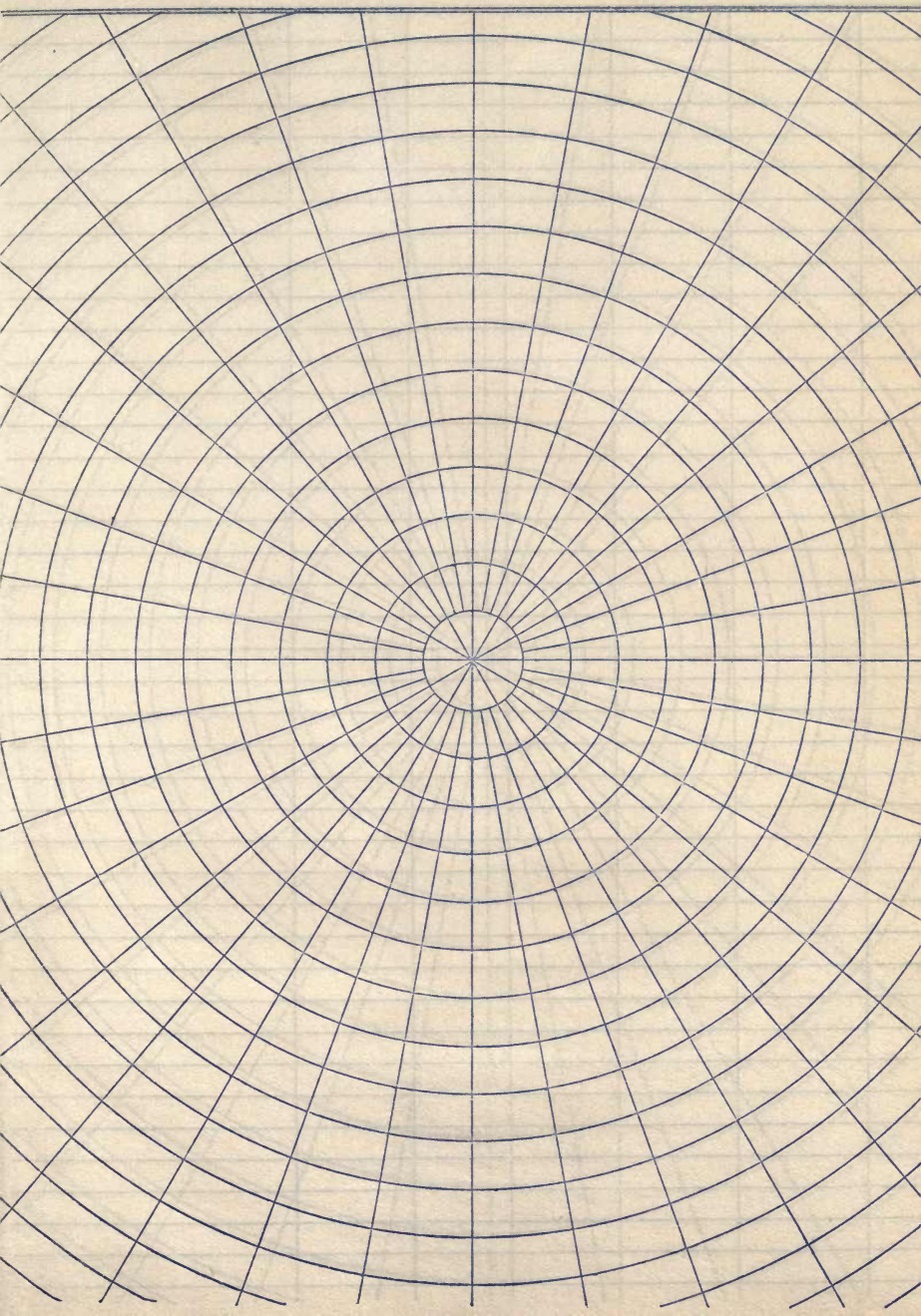
In determining the necessary data for obtaining elevations, it is often convenient to sight at the rod at some point above or below the H.I. point, and in such cases a + or — correction indicating this can be noted under the "remarks" column. The columns headed "Differences of Elevation," and "Elevation" are for the office reductions.

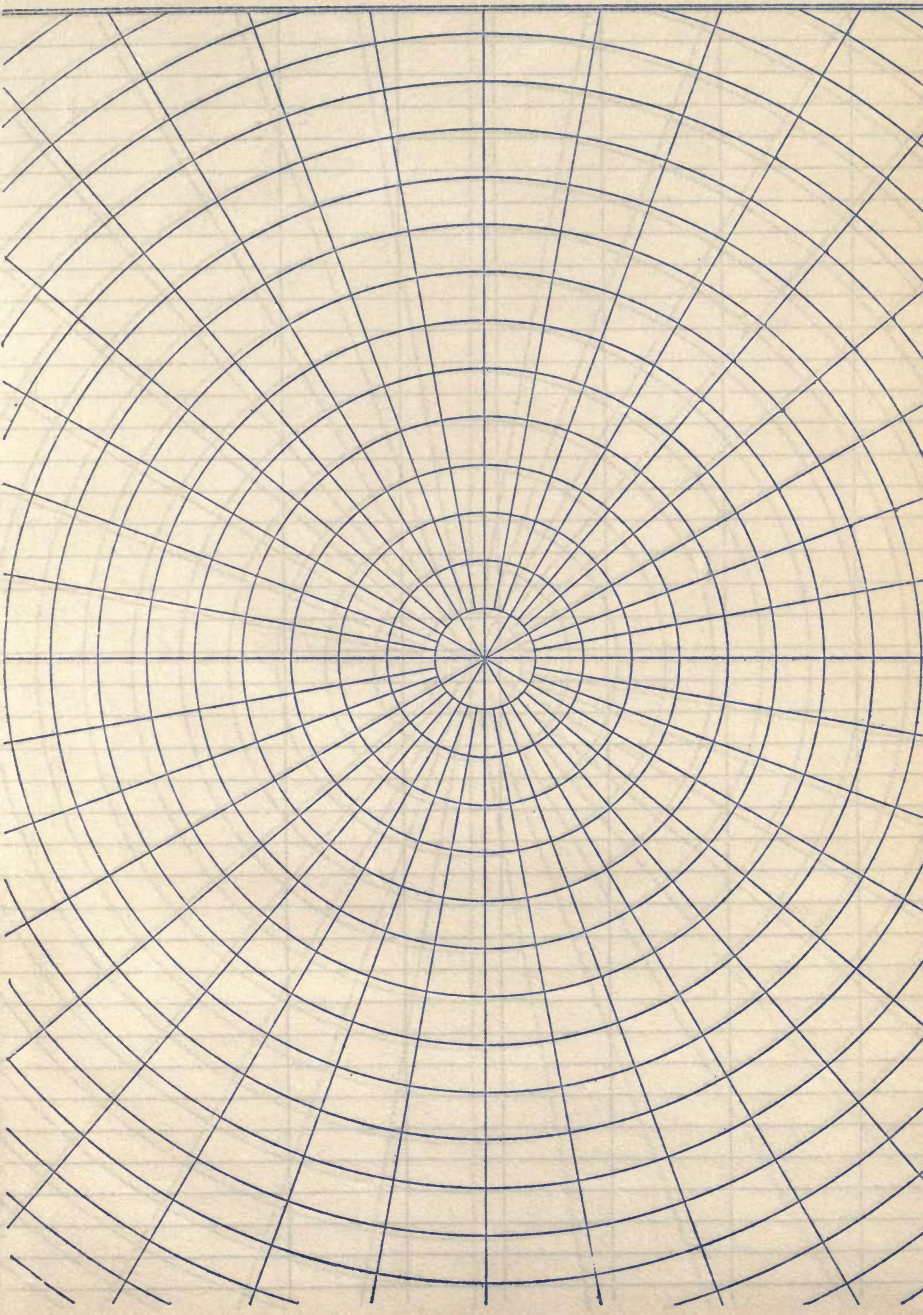
The right-hand page of the book is reserved for the concentric circle and radial rulings upon which the sketches are drawn. The concentric circles are one-quarter of an inch apart; corresponding conveniently to scales of 100, 400, or 800 feet to the inch, which ever may be most suitable to the work in hand. The topographer predetermines the scale to be used in each particular case. The radial lines are 10° apart, the position of a point being easily interpolated to the nearest degree.

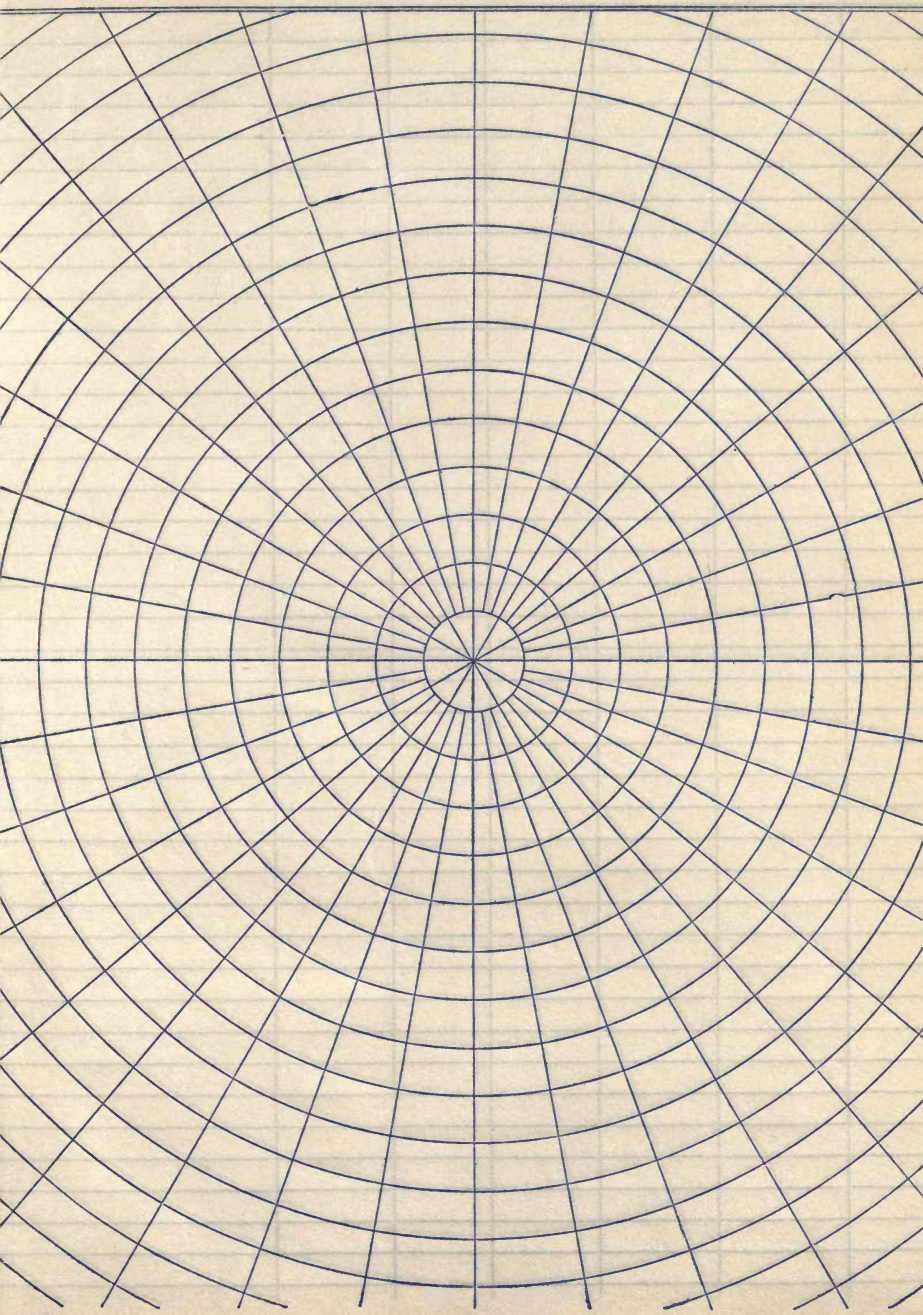
As soon as the recorder has noted down the observed azimuth, distance, and vertical angle on the left-hand page, he proceeds to plot the corresponding point approximately in its true position on the sketch page. Each point being designated by its number. As fast as the controlling points are plotted the sketch is drawn in. It is not necessary to reduce the elevations in the field, the sketch as drawn need only indicate the configuration.

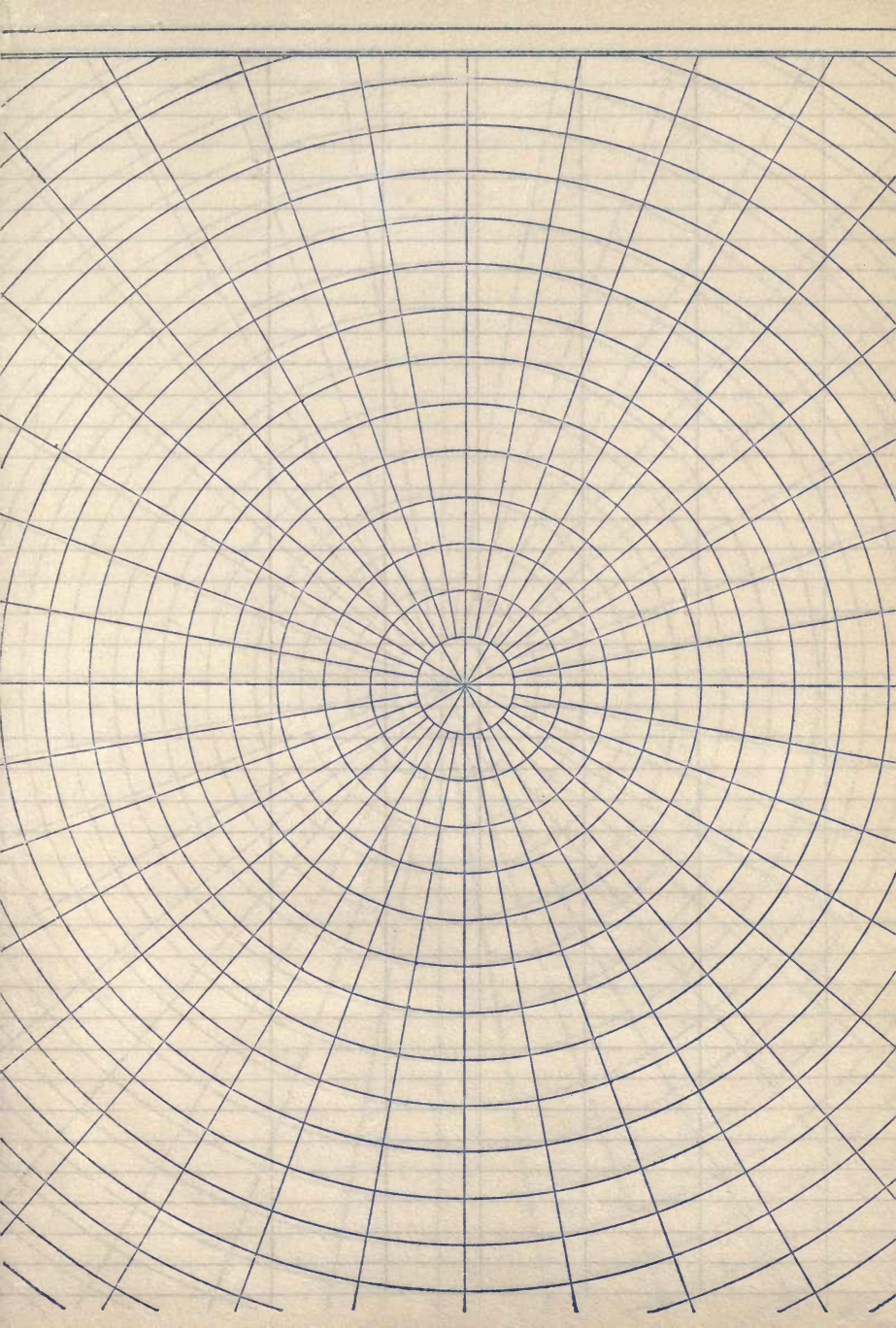
DANIEL LAWRENCE TURNER.

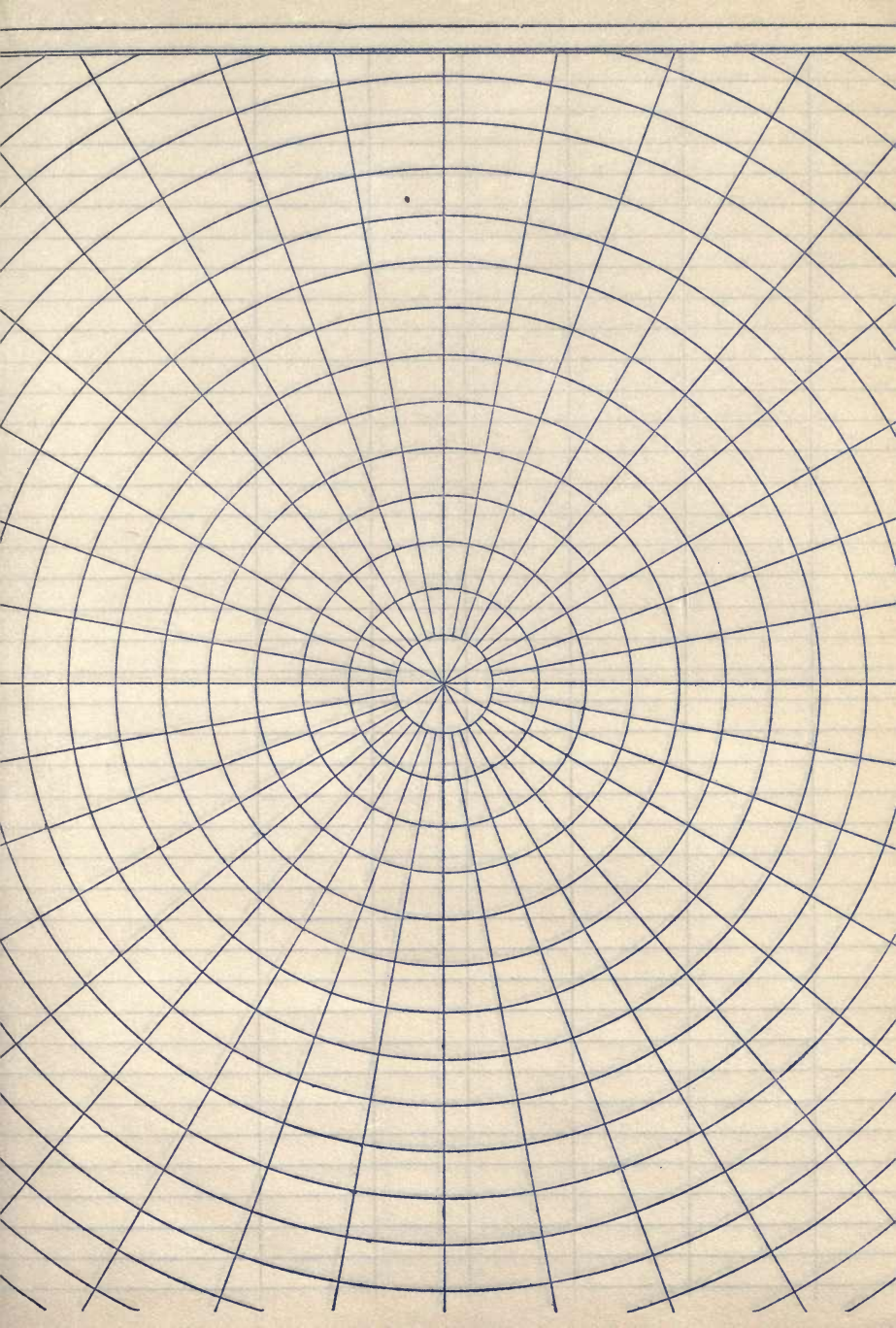
Cambridge, Mass., May, 1901.

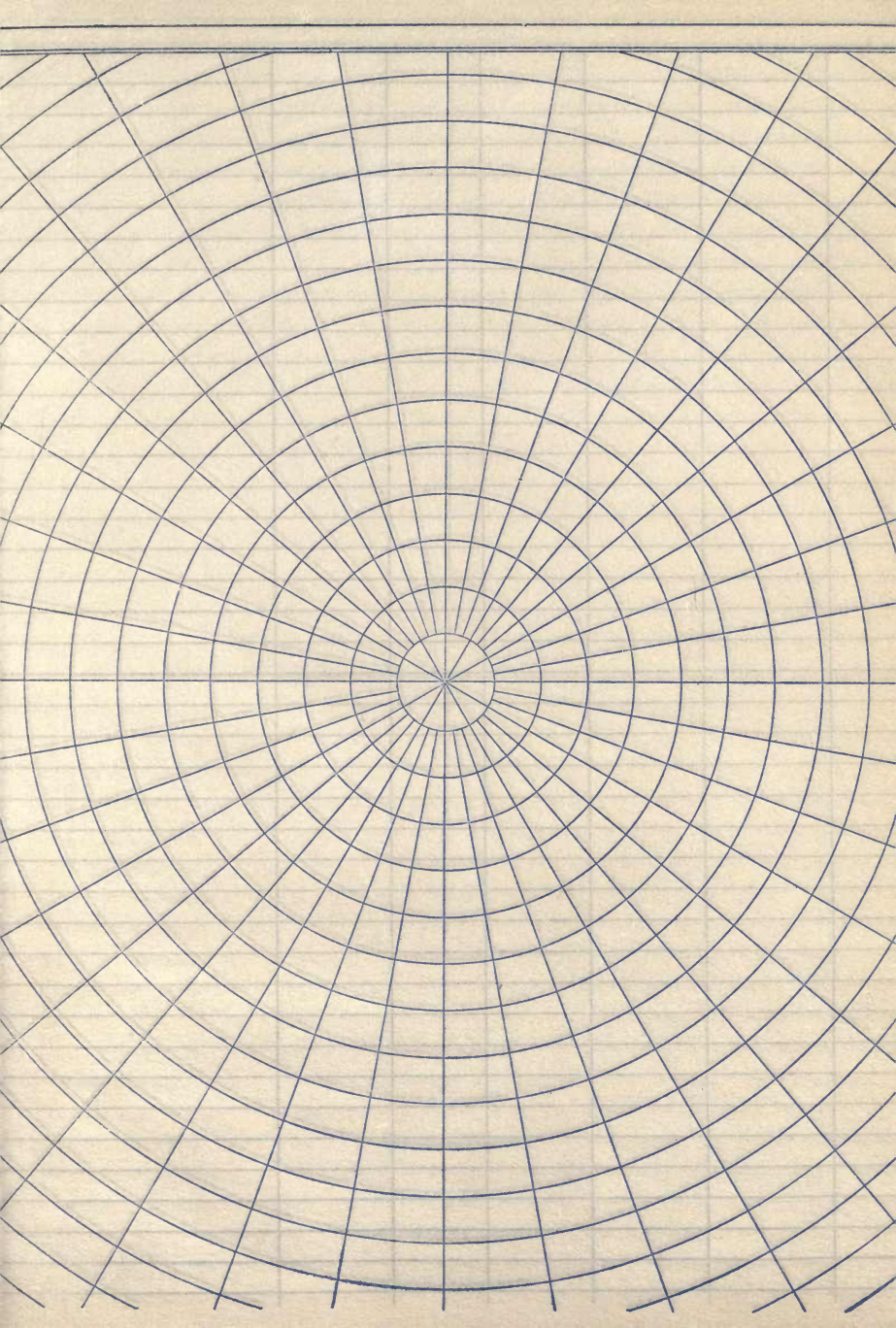


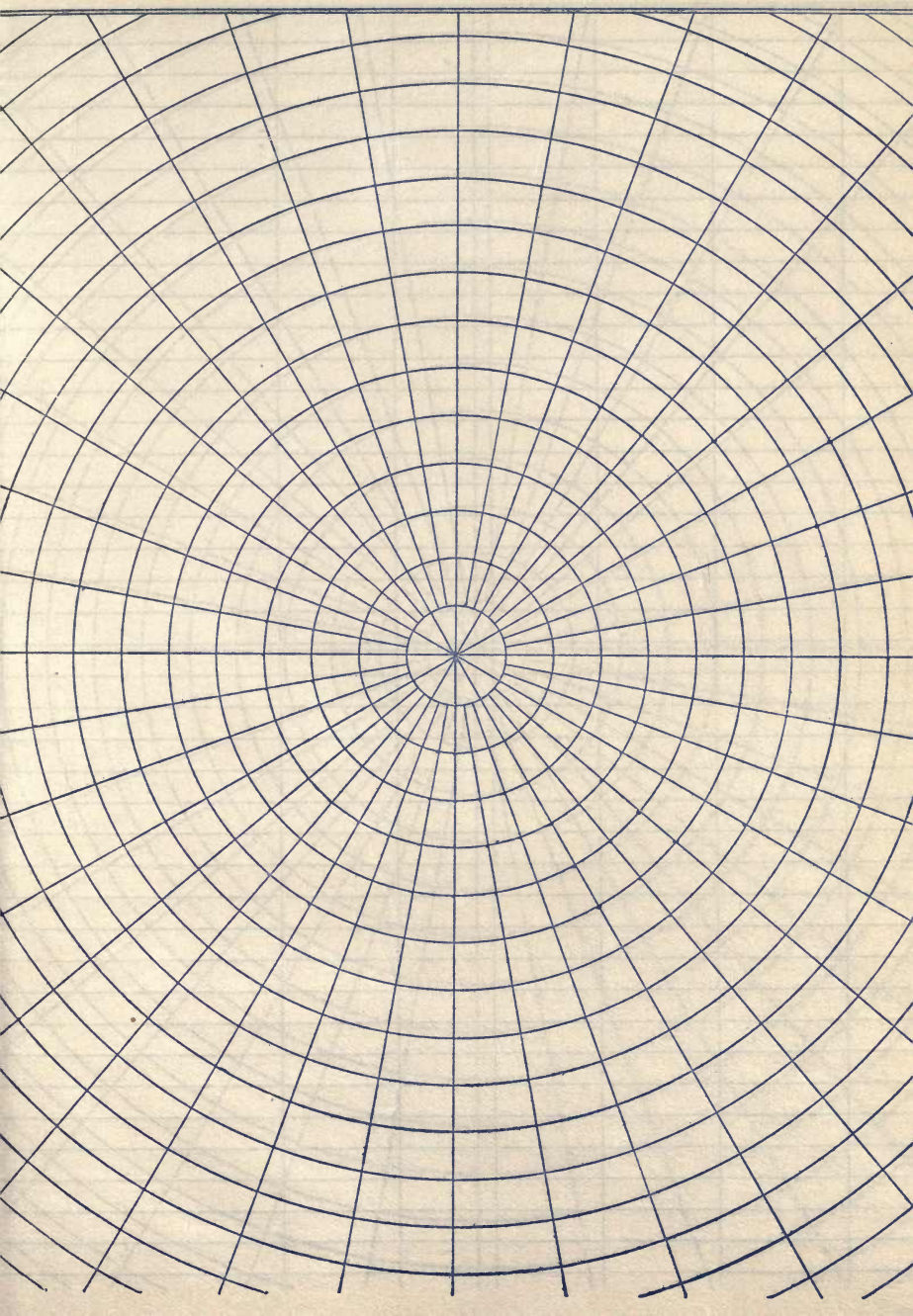


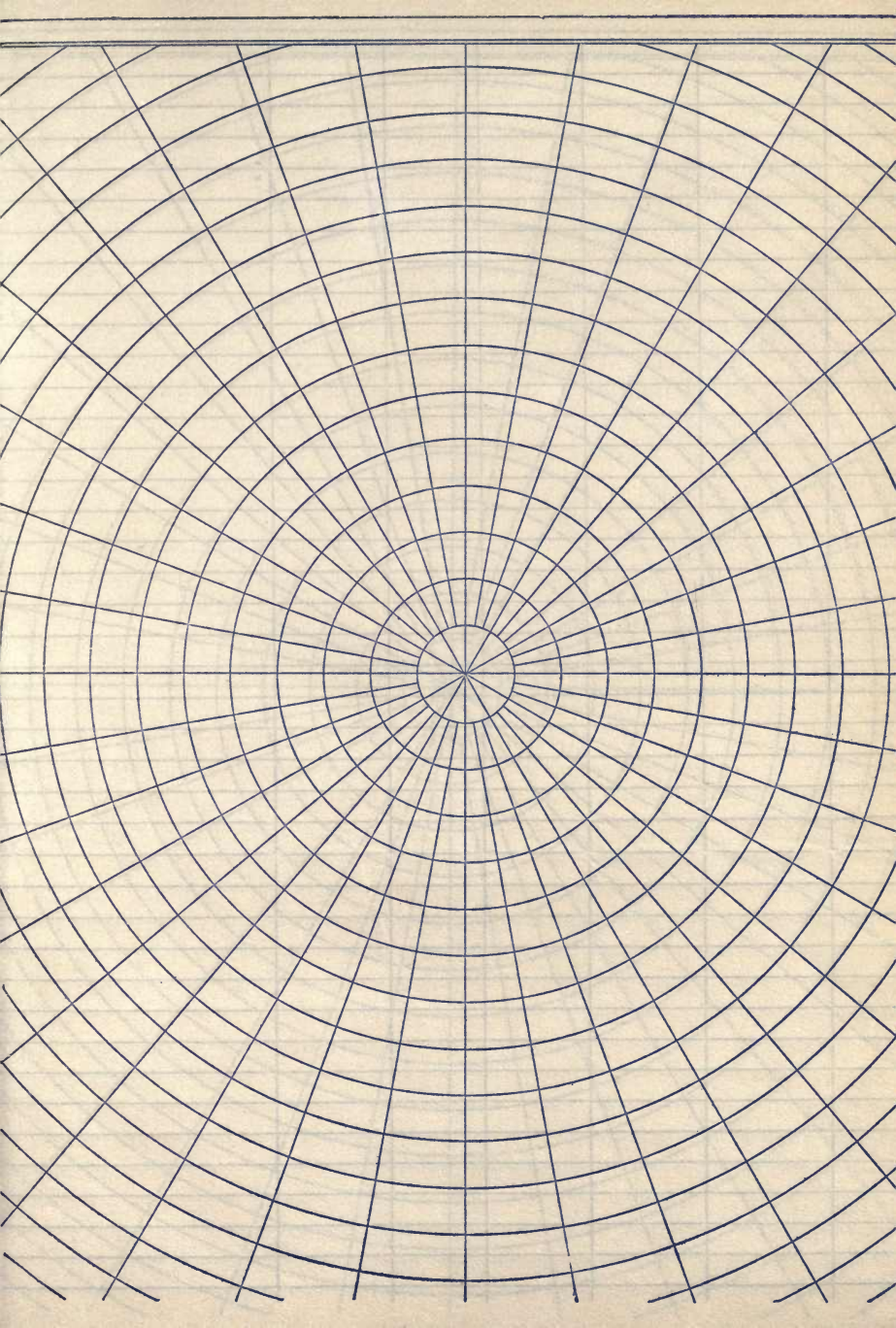


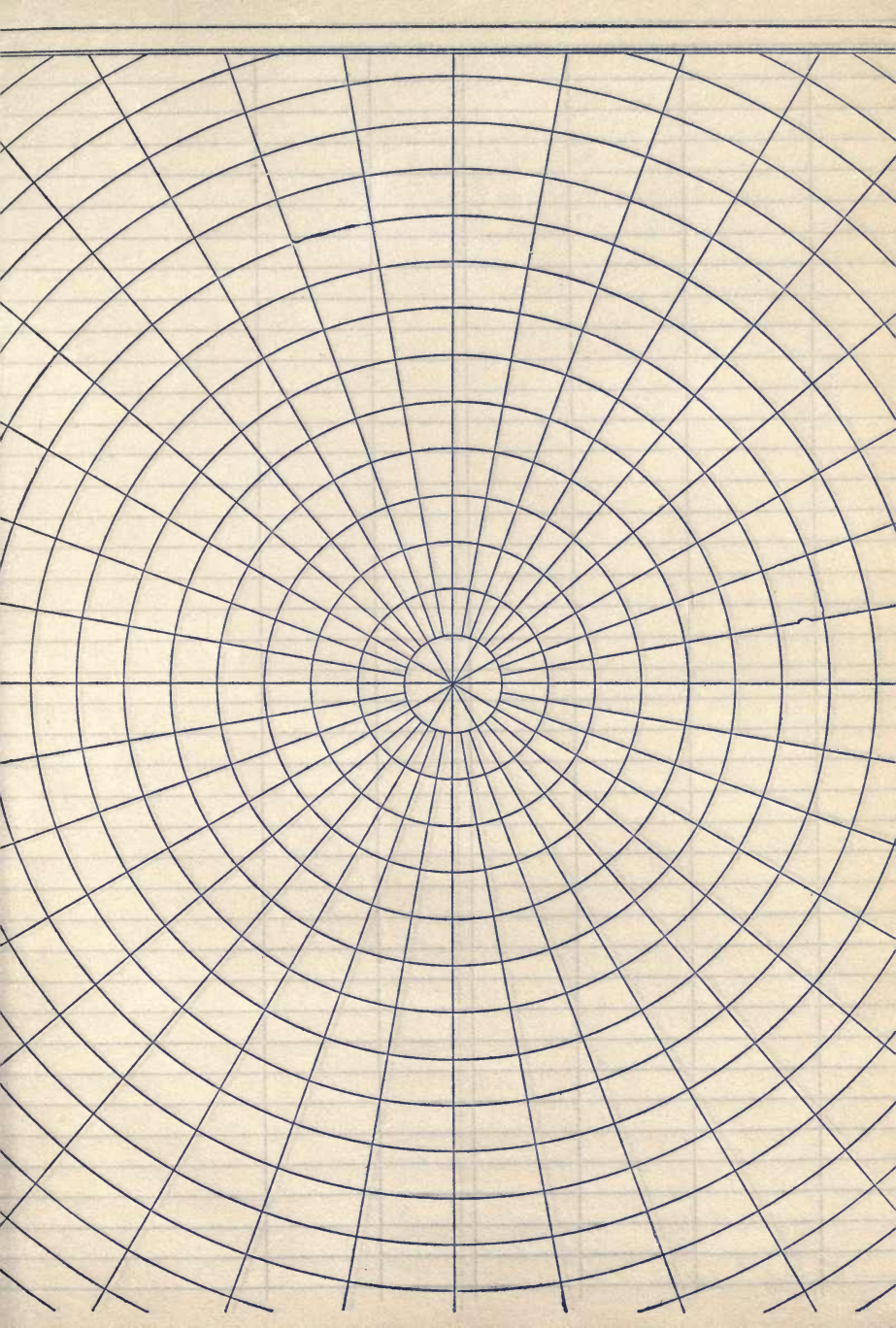


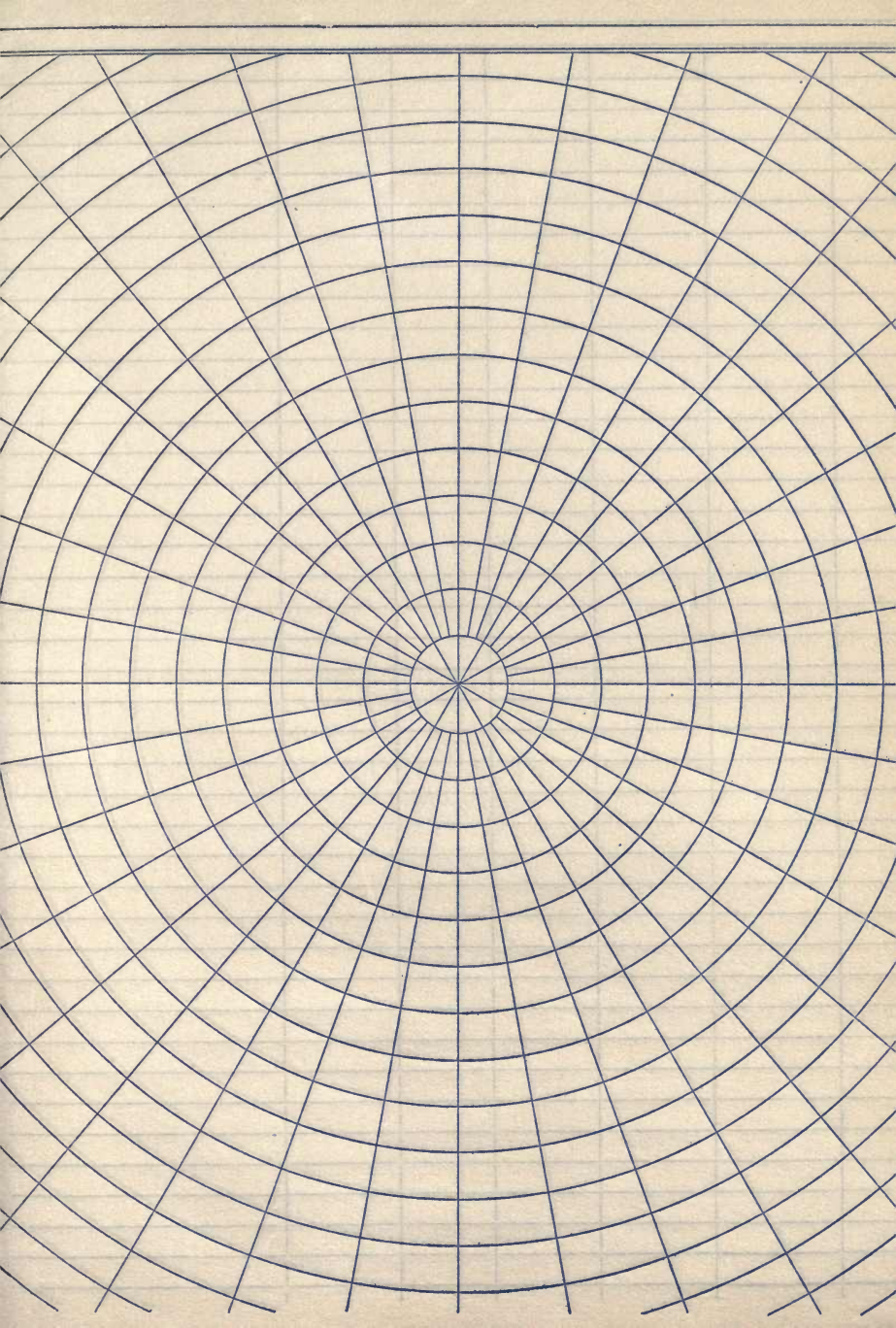


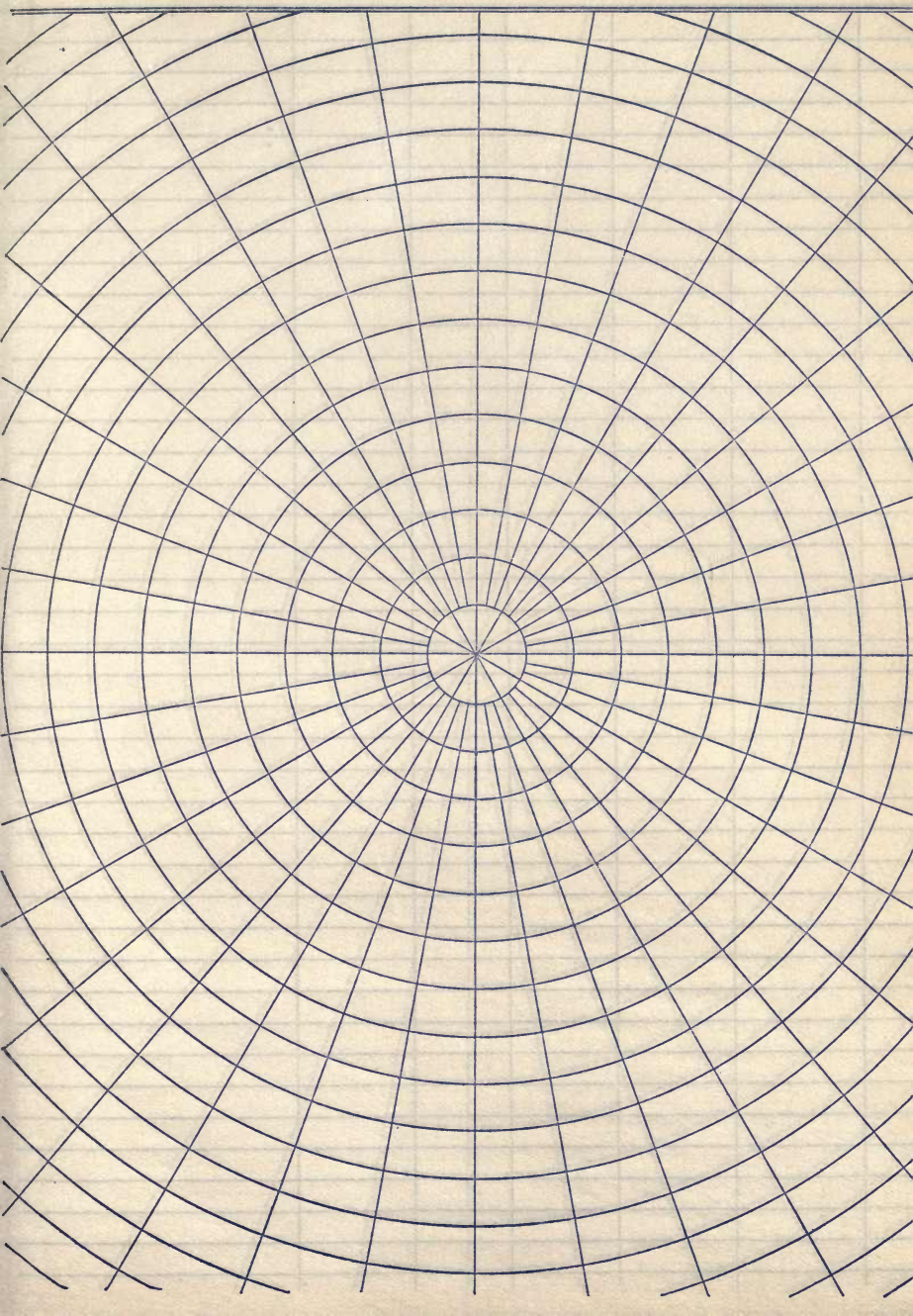


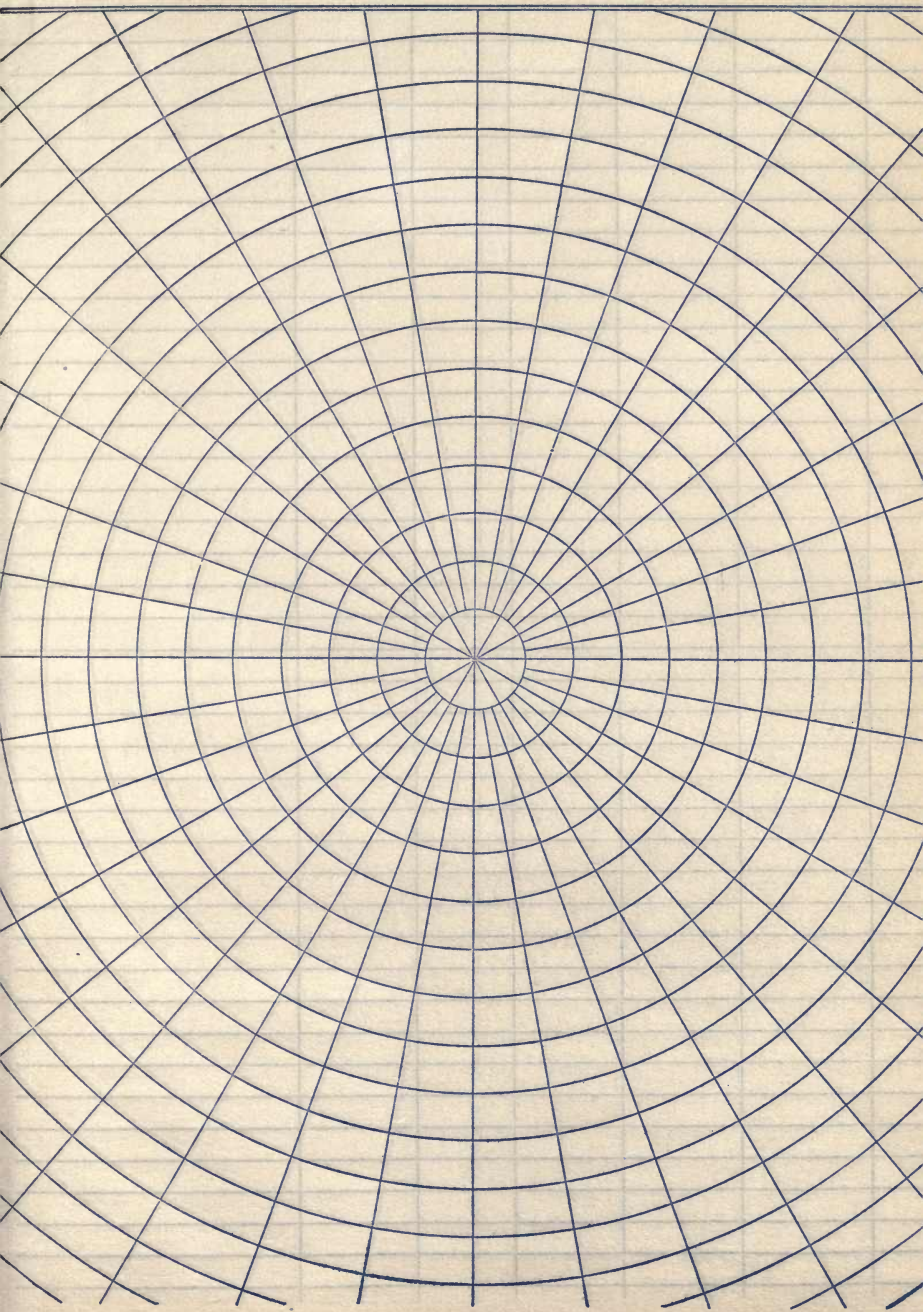


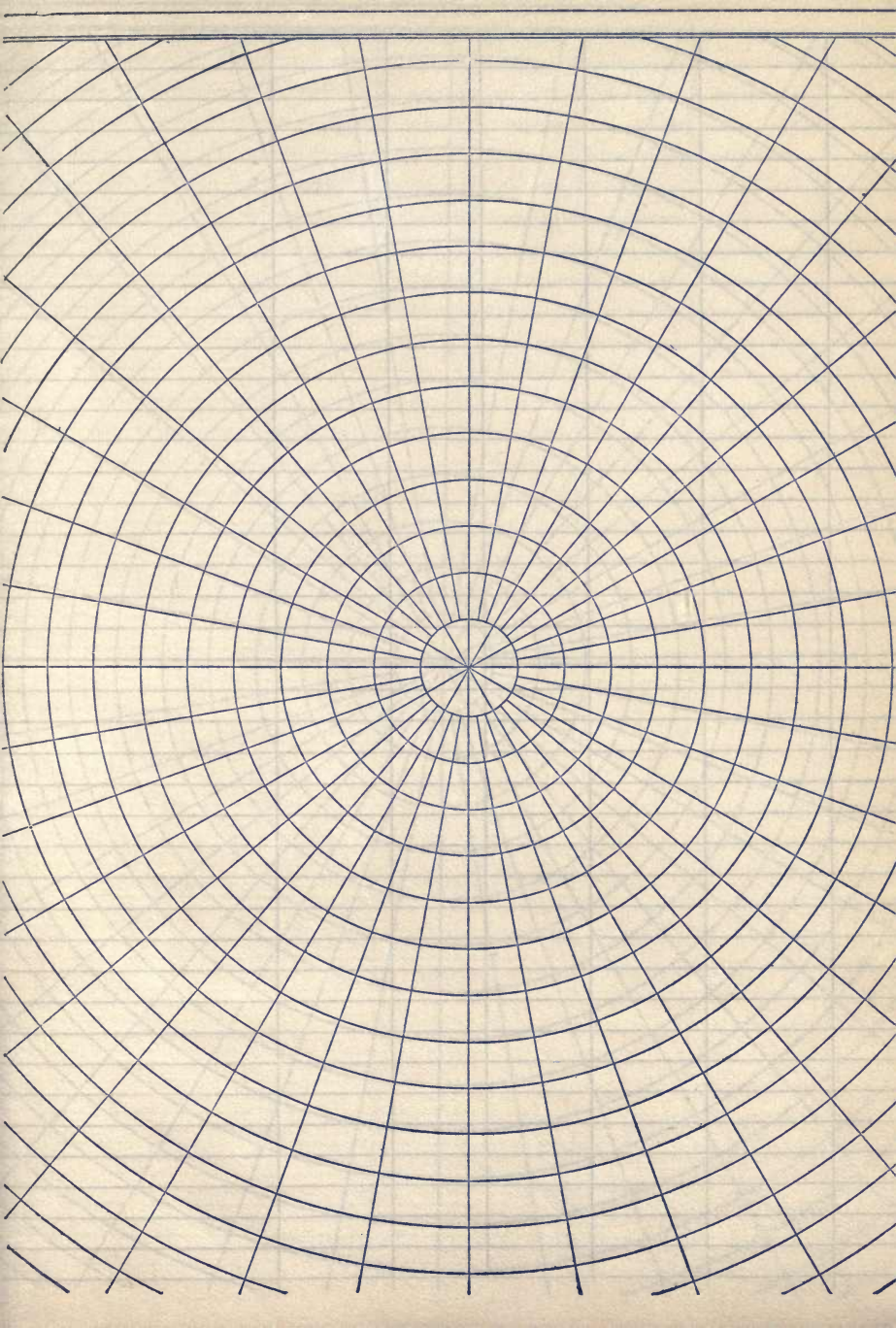


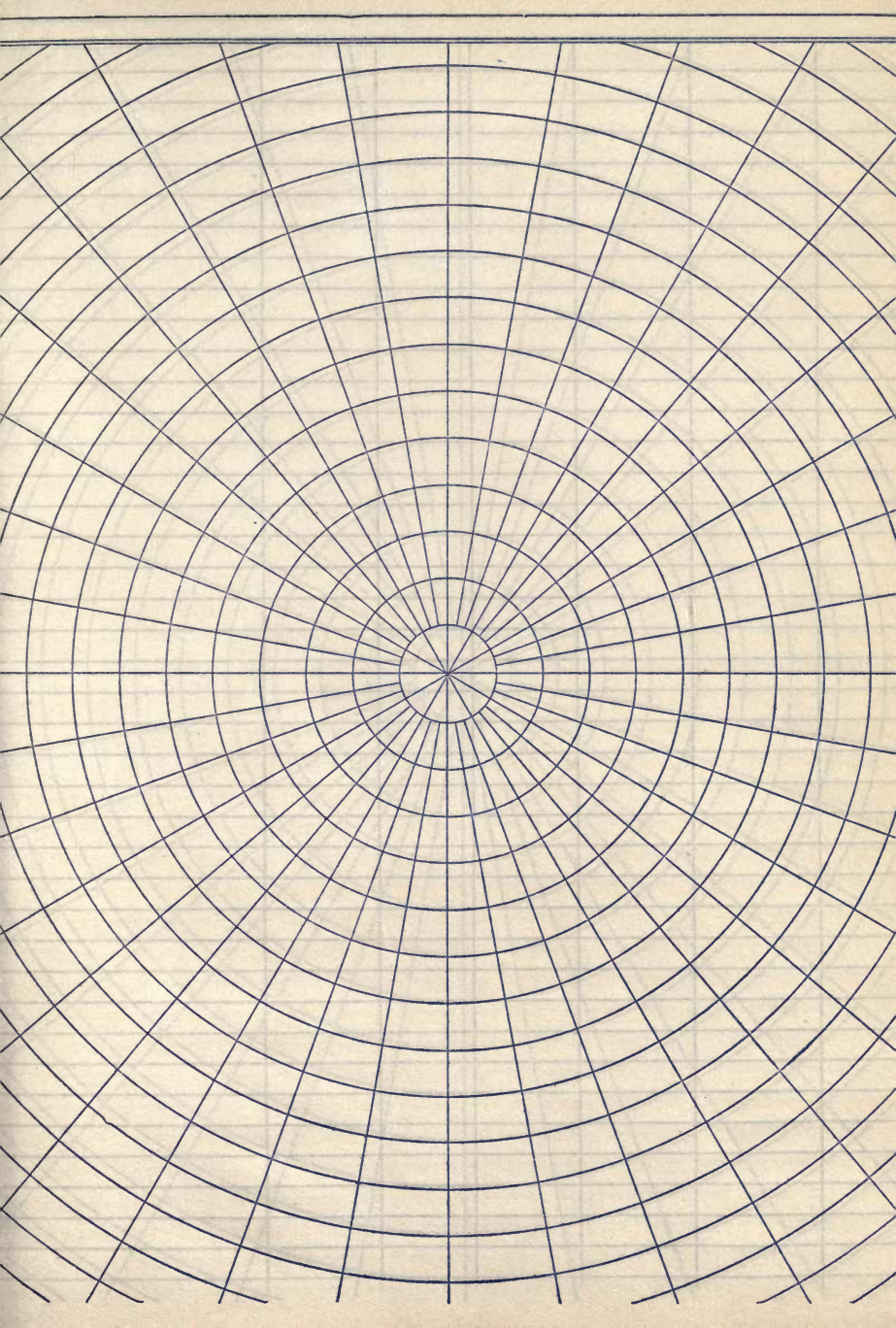


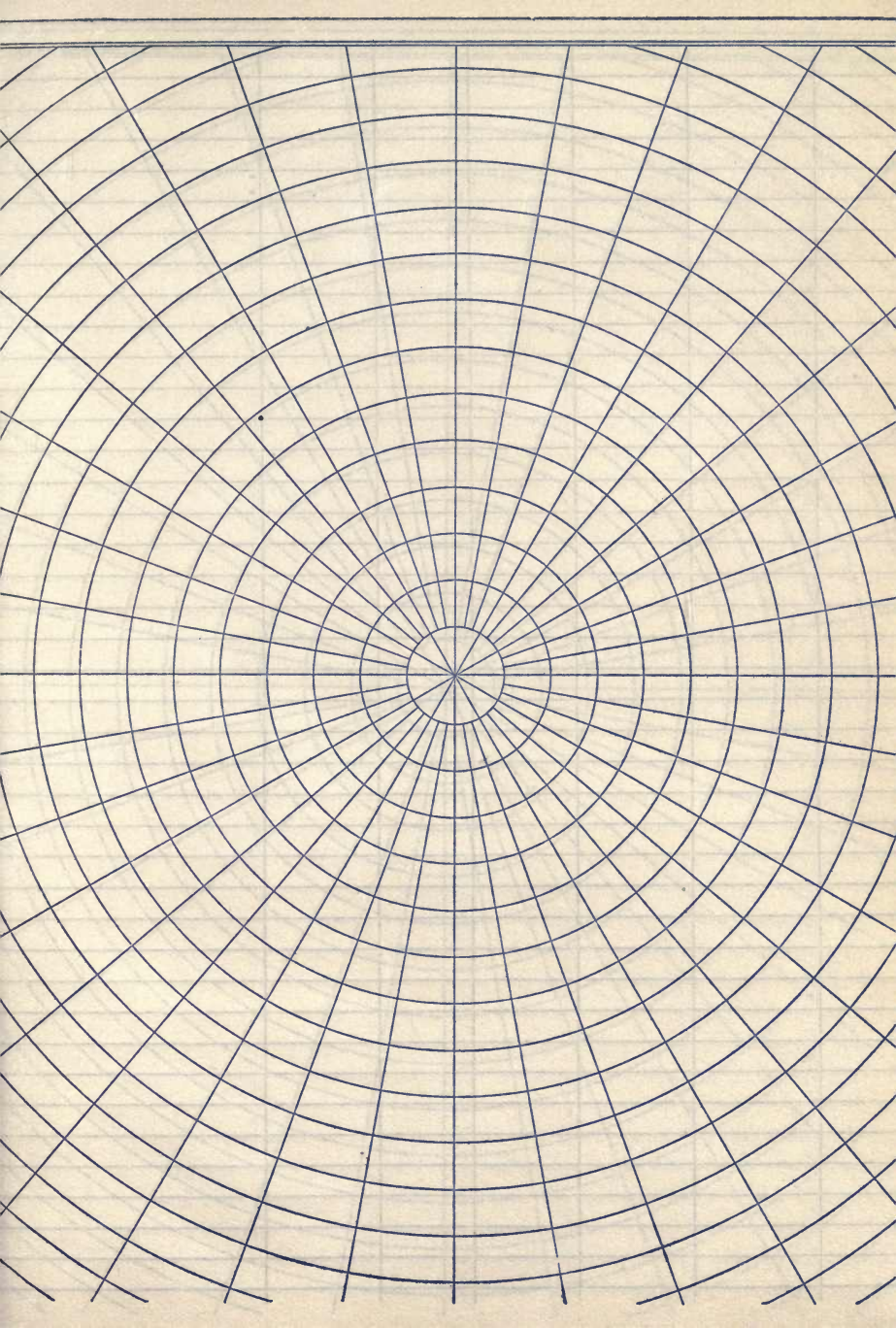


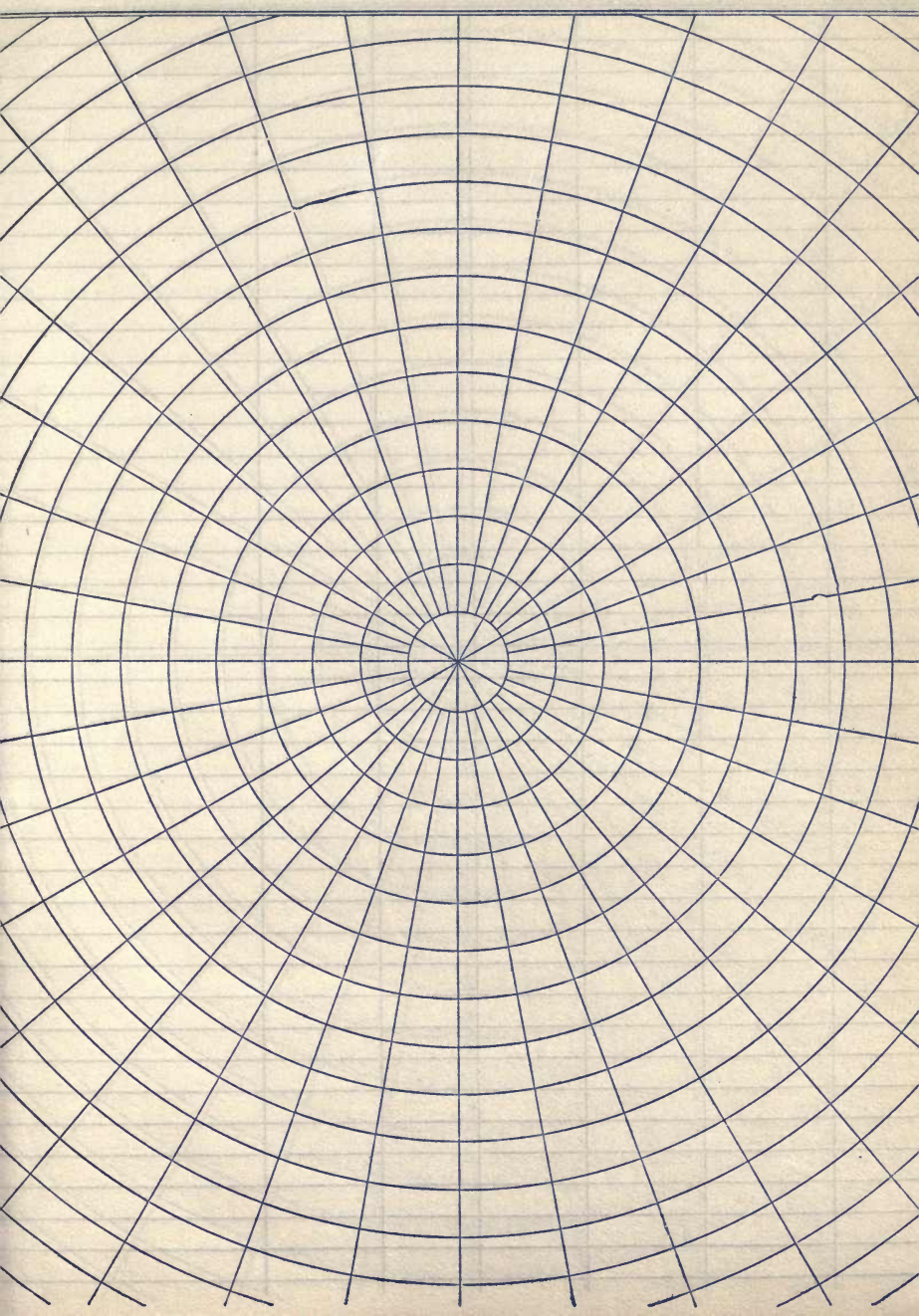


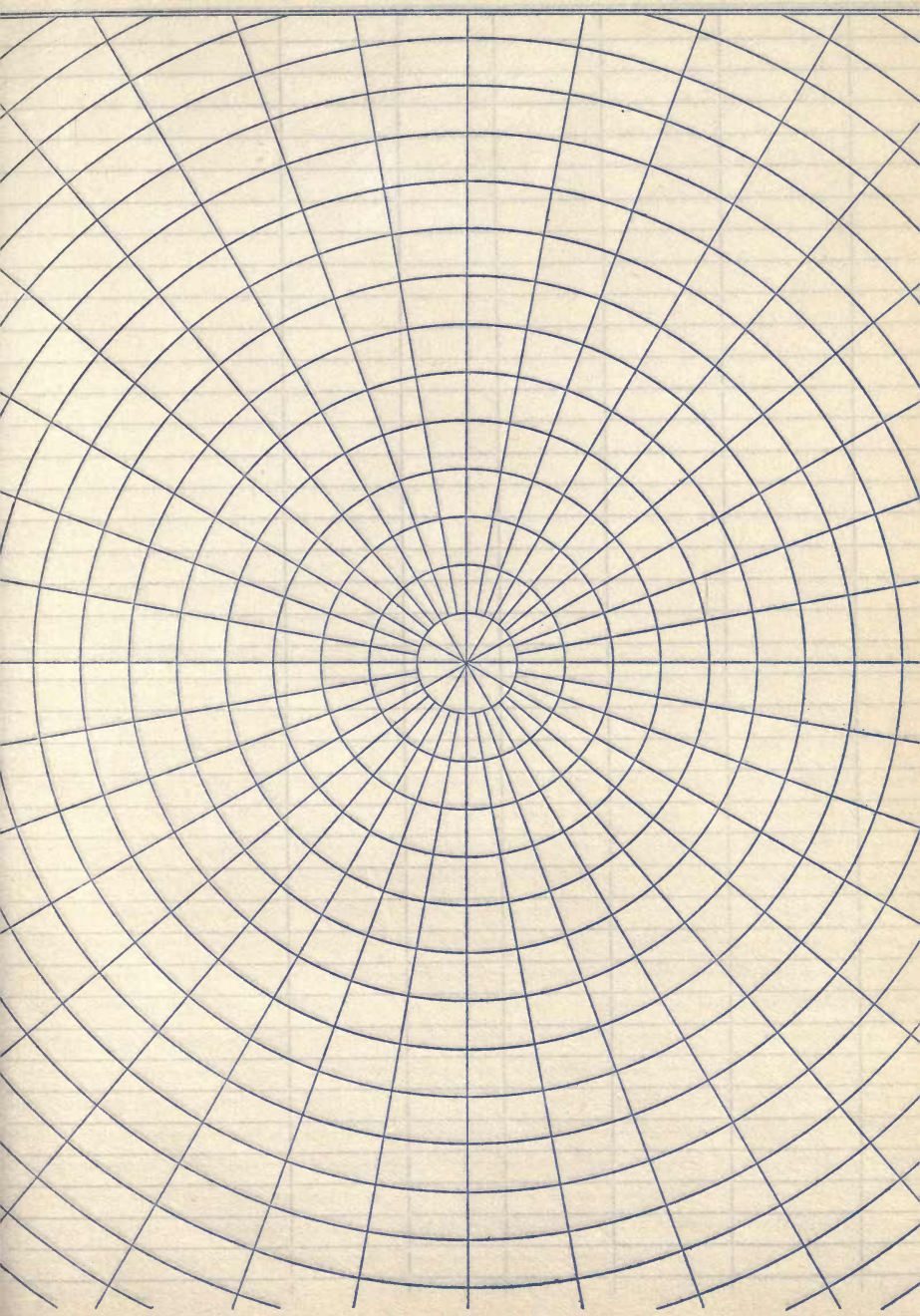


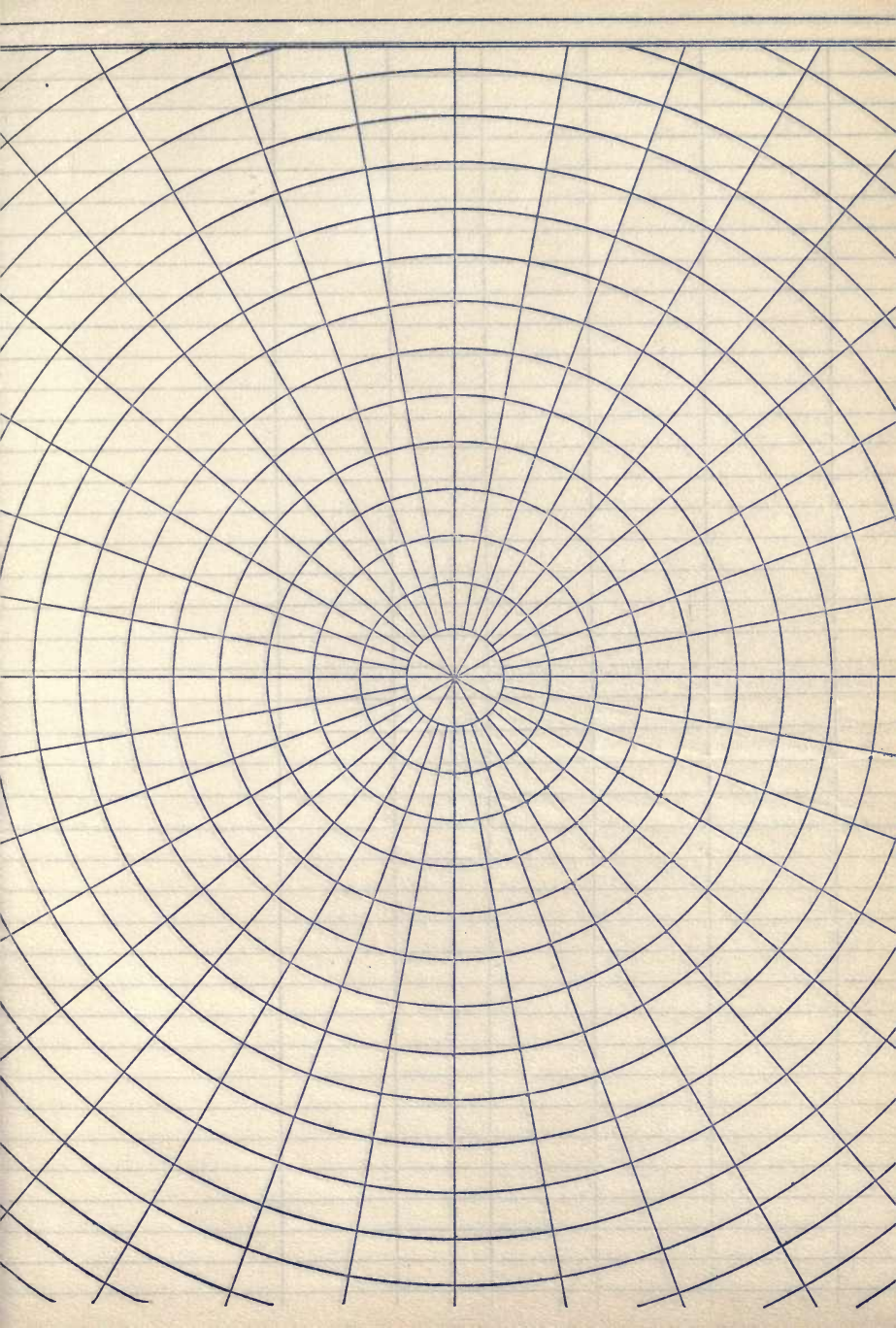


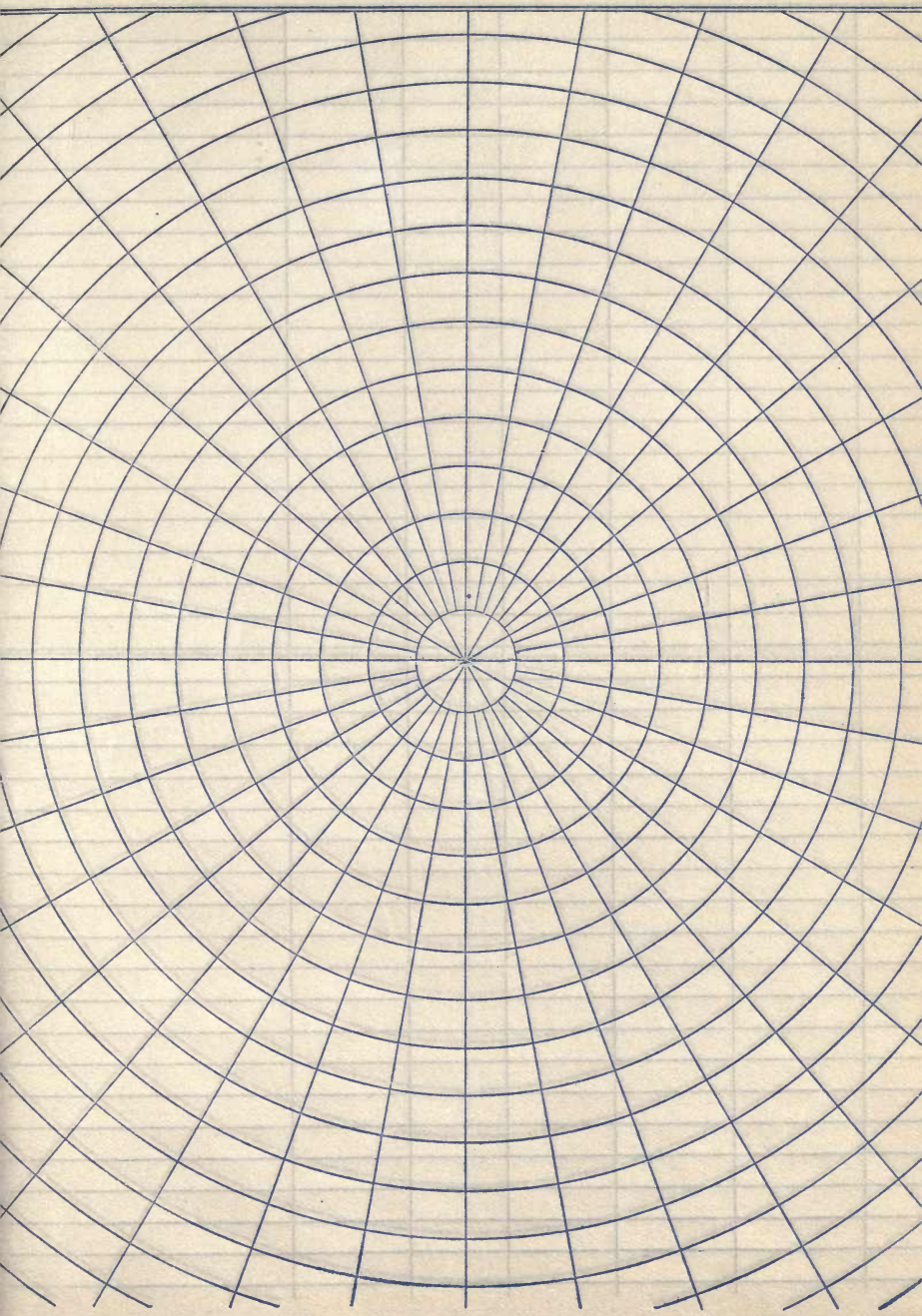


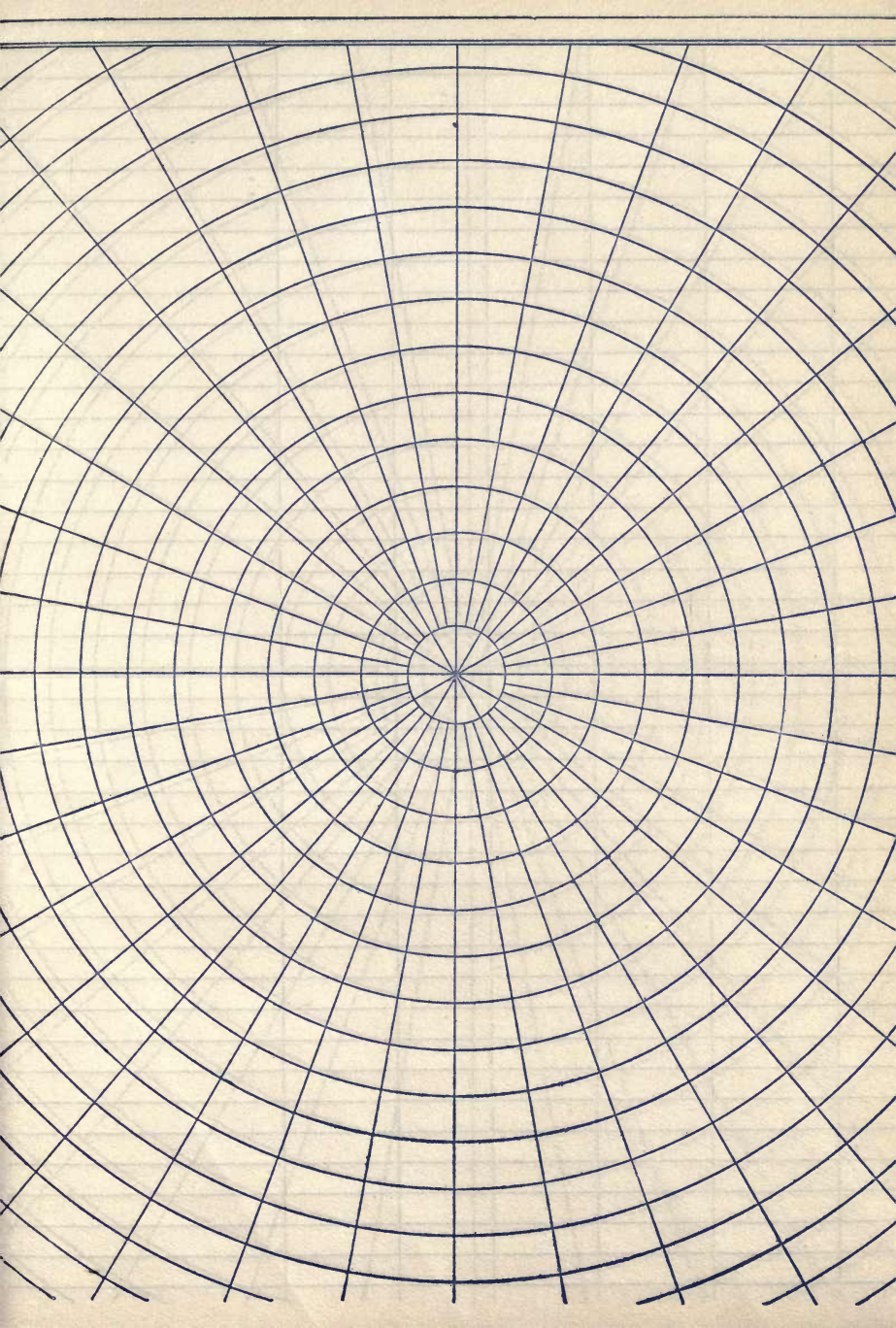


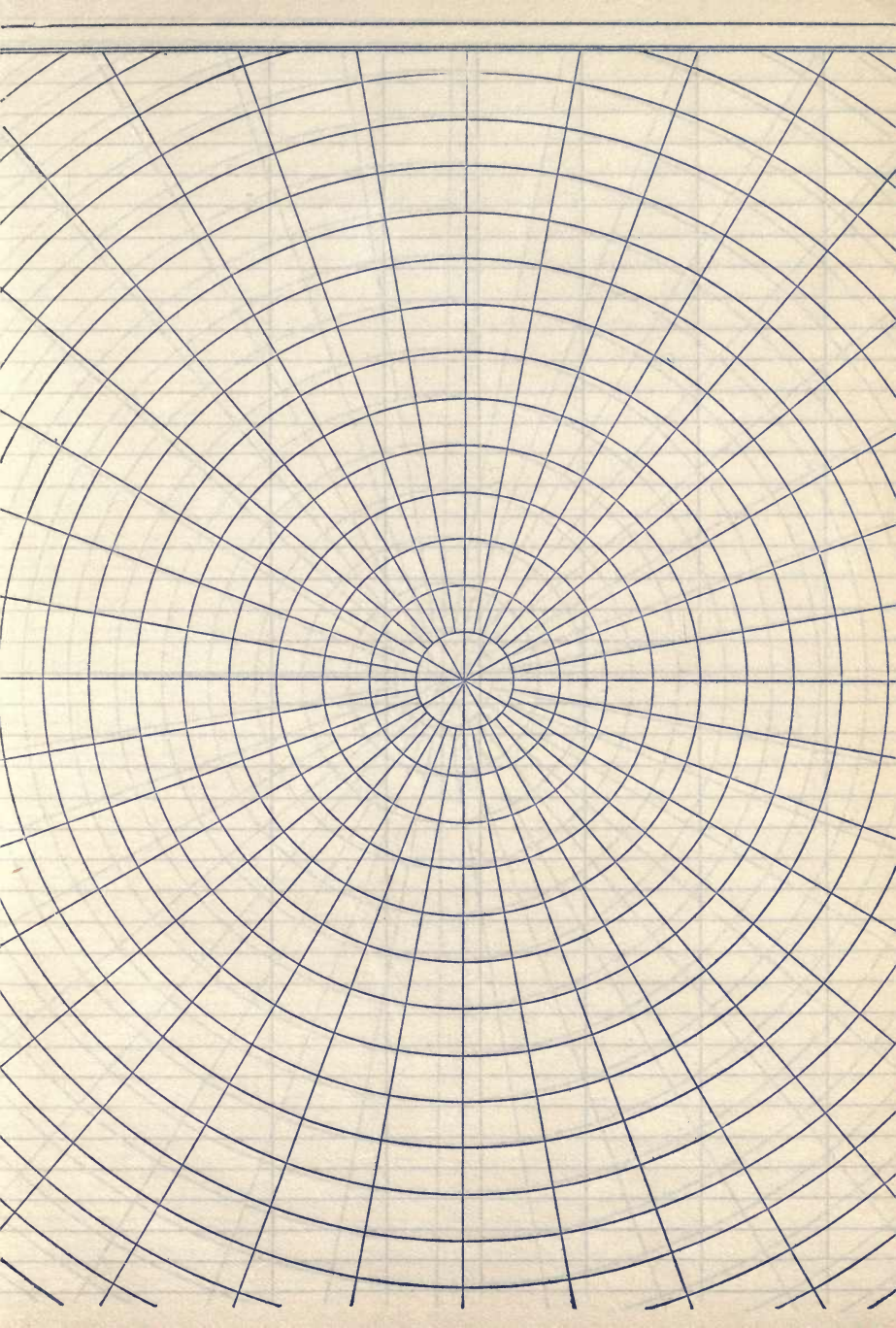


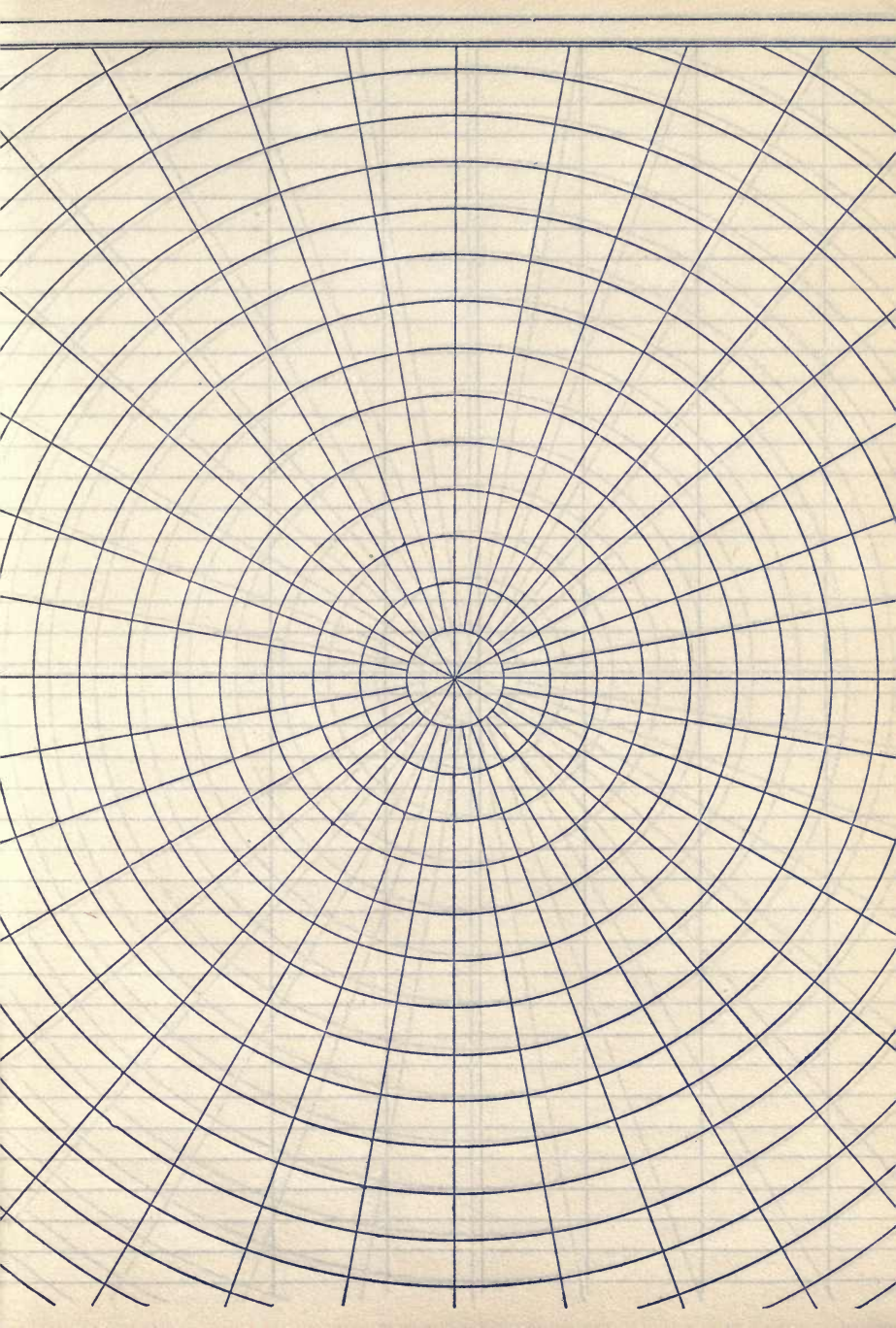


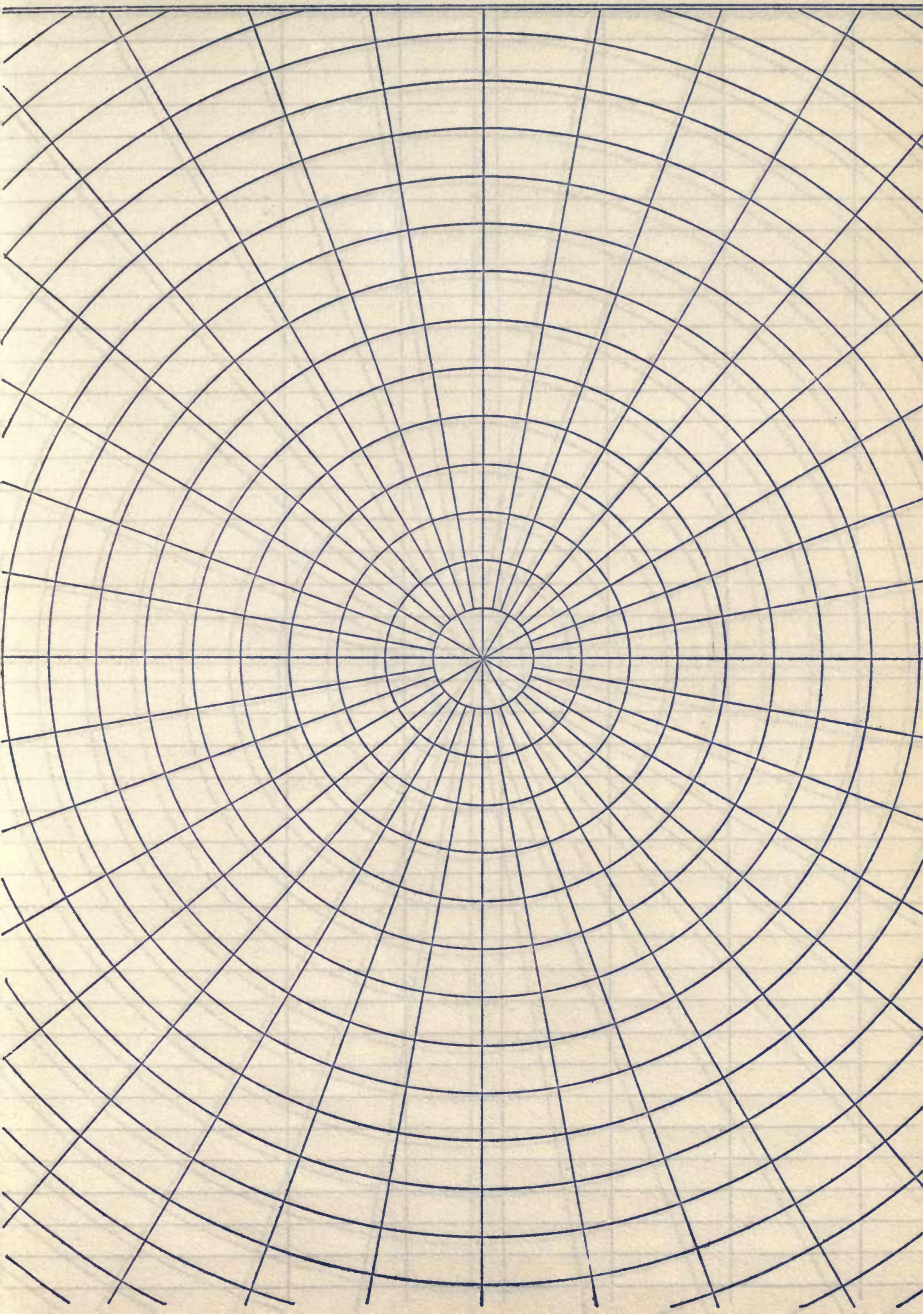


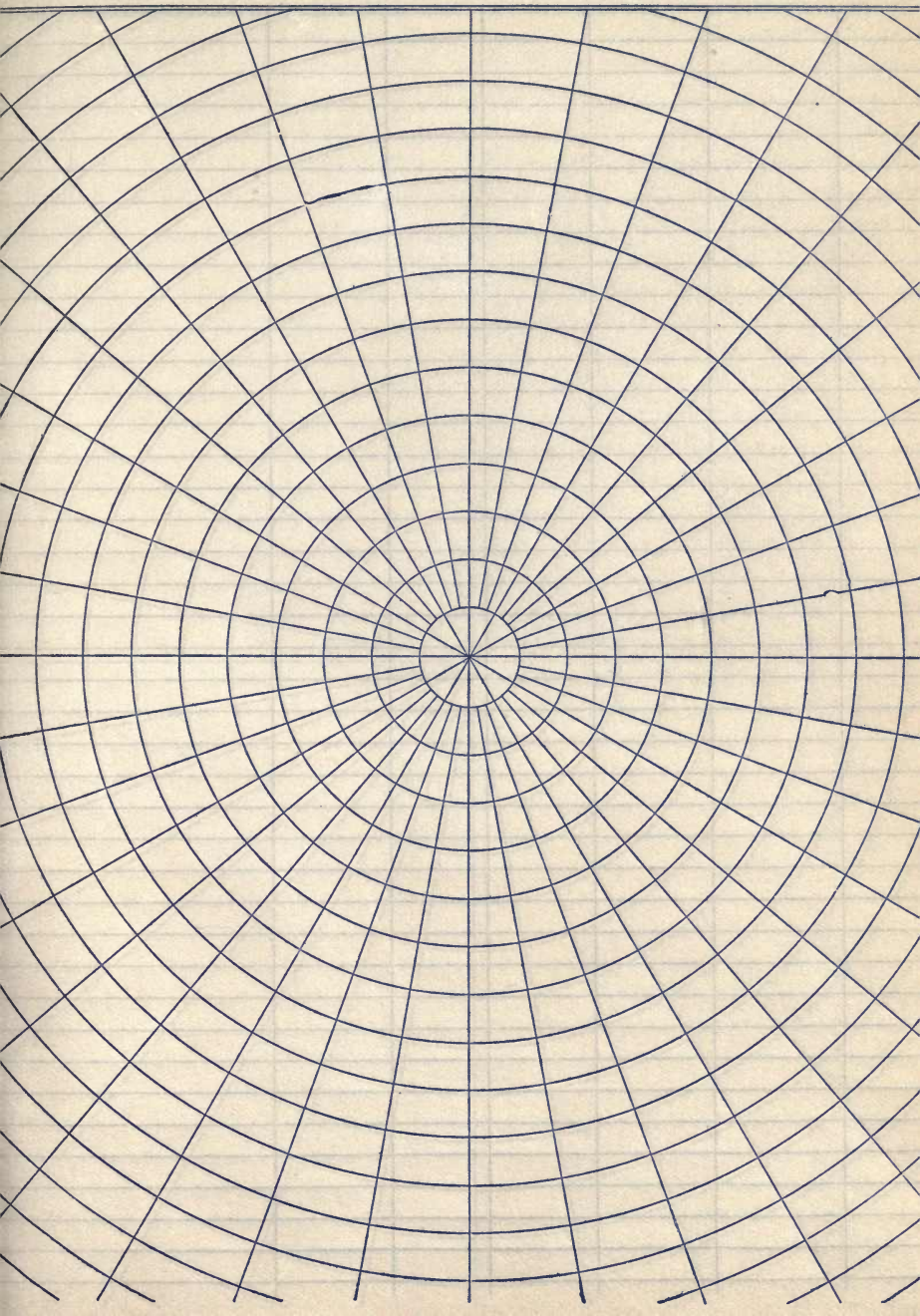


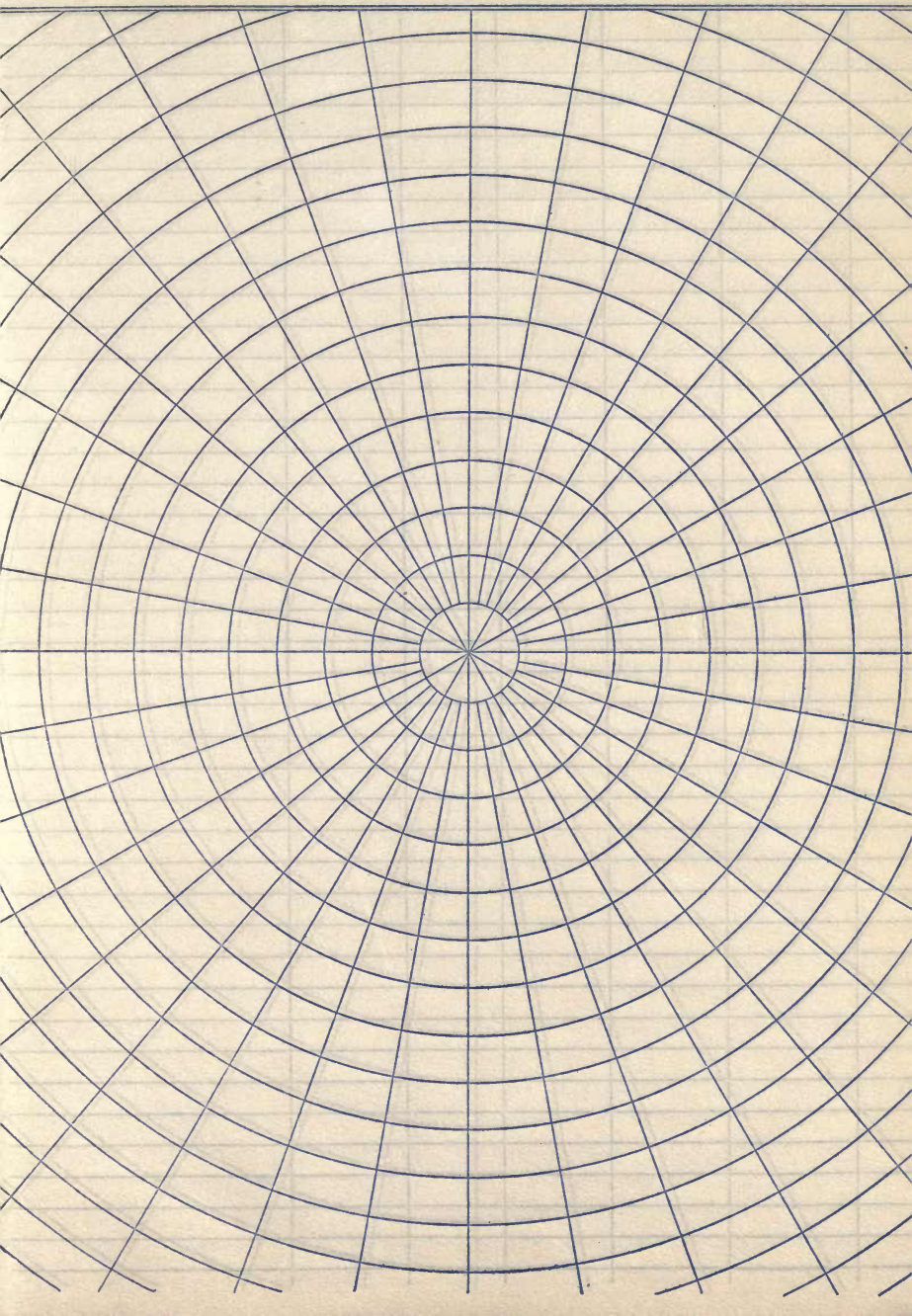


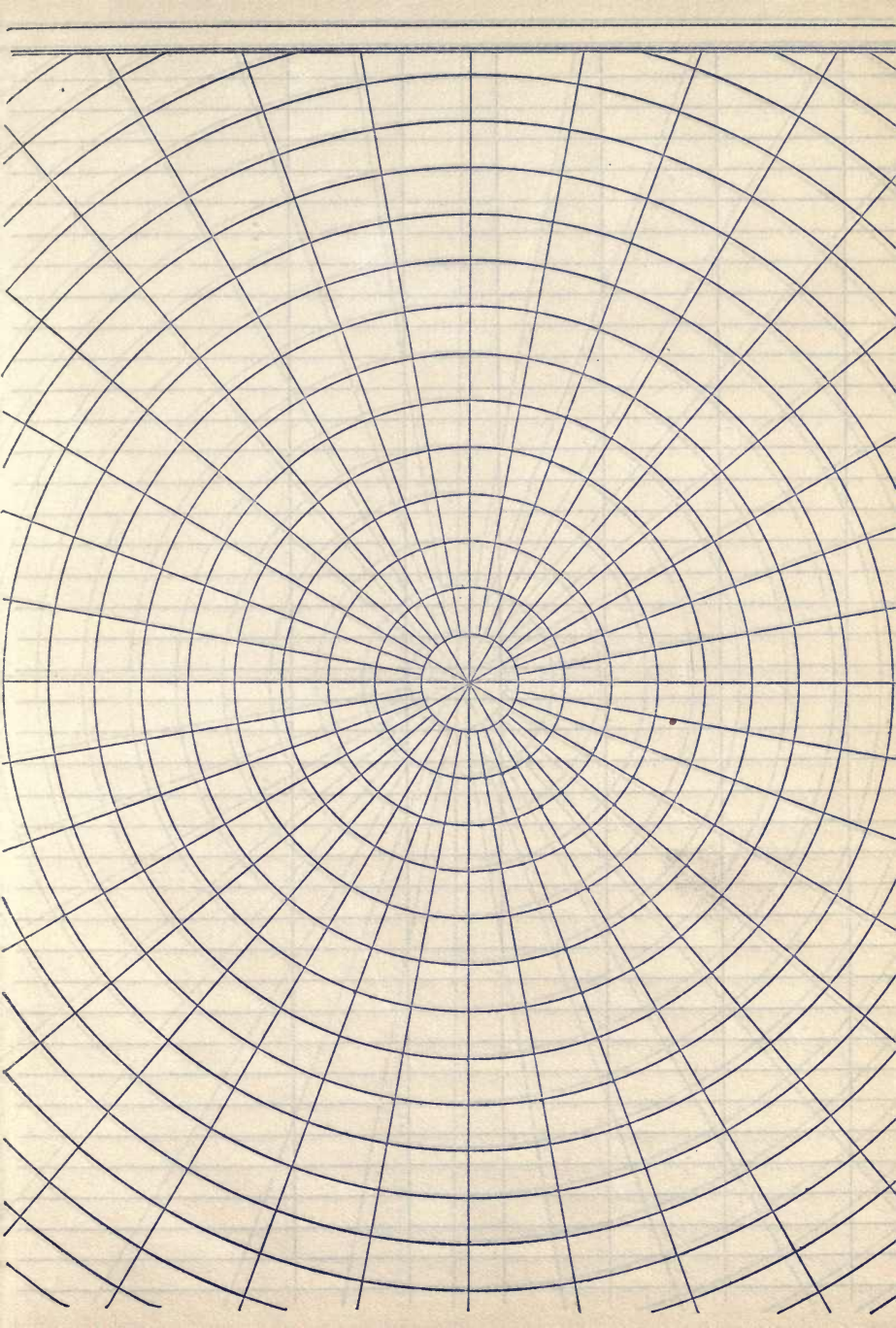


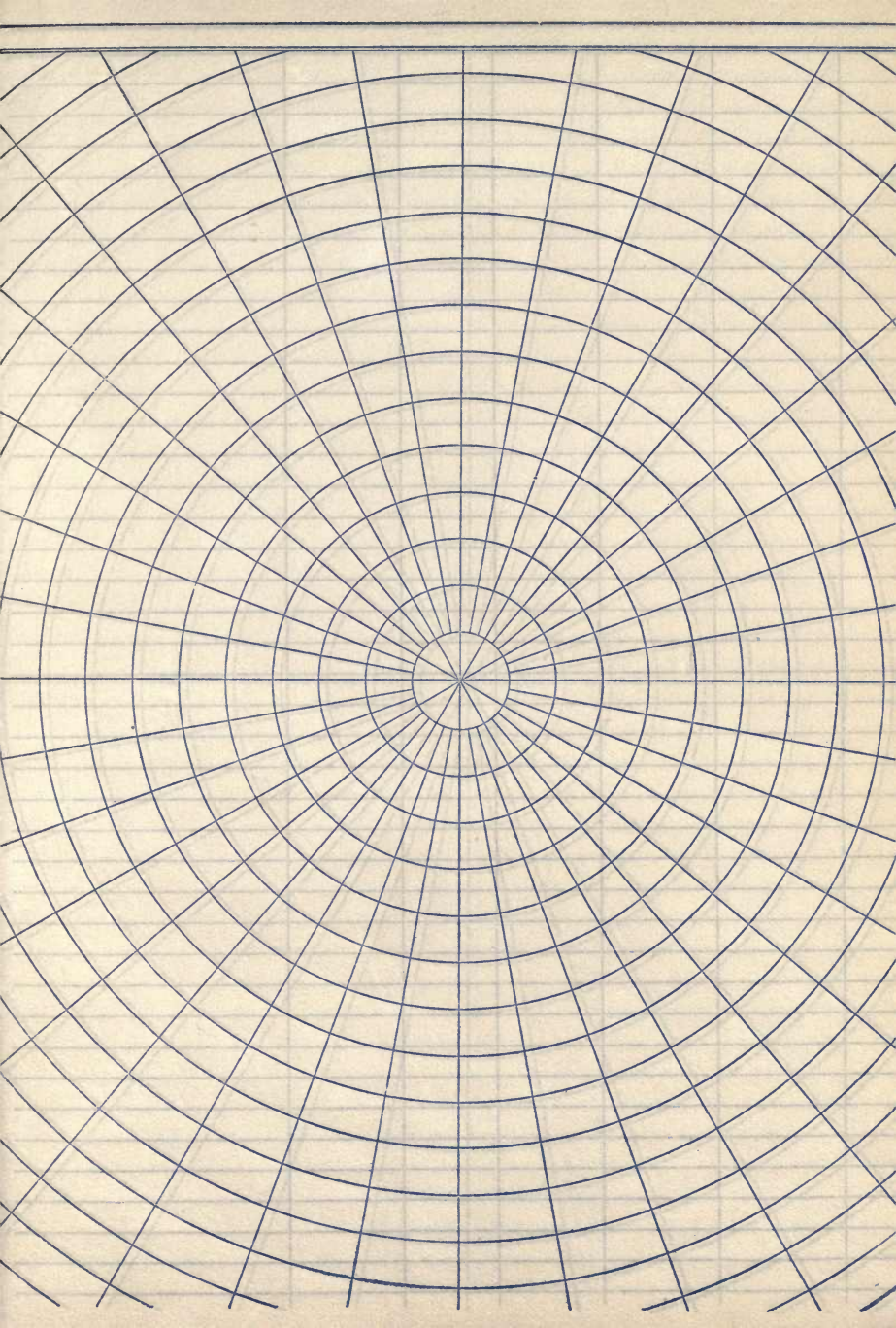


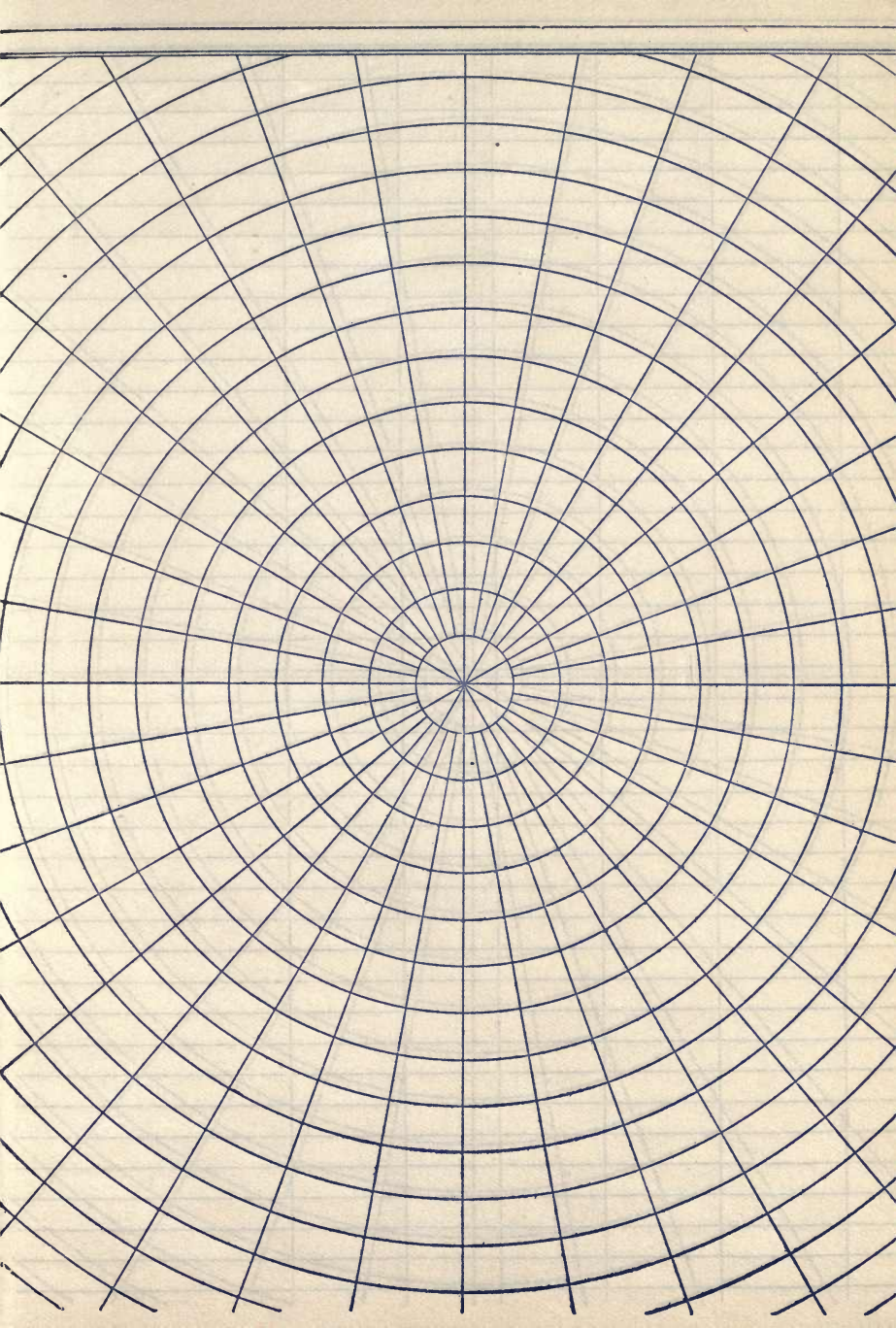


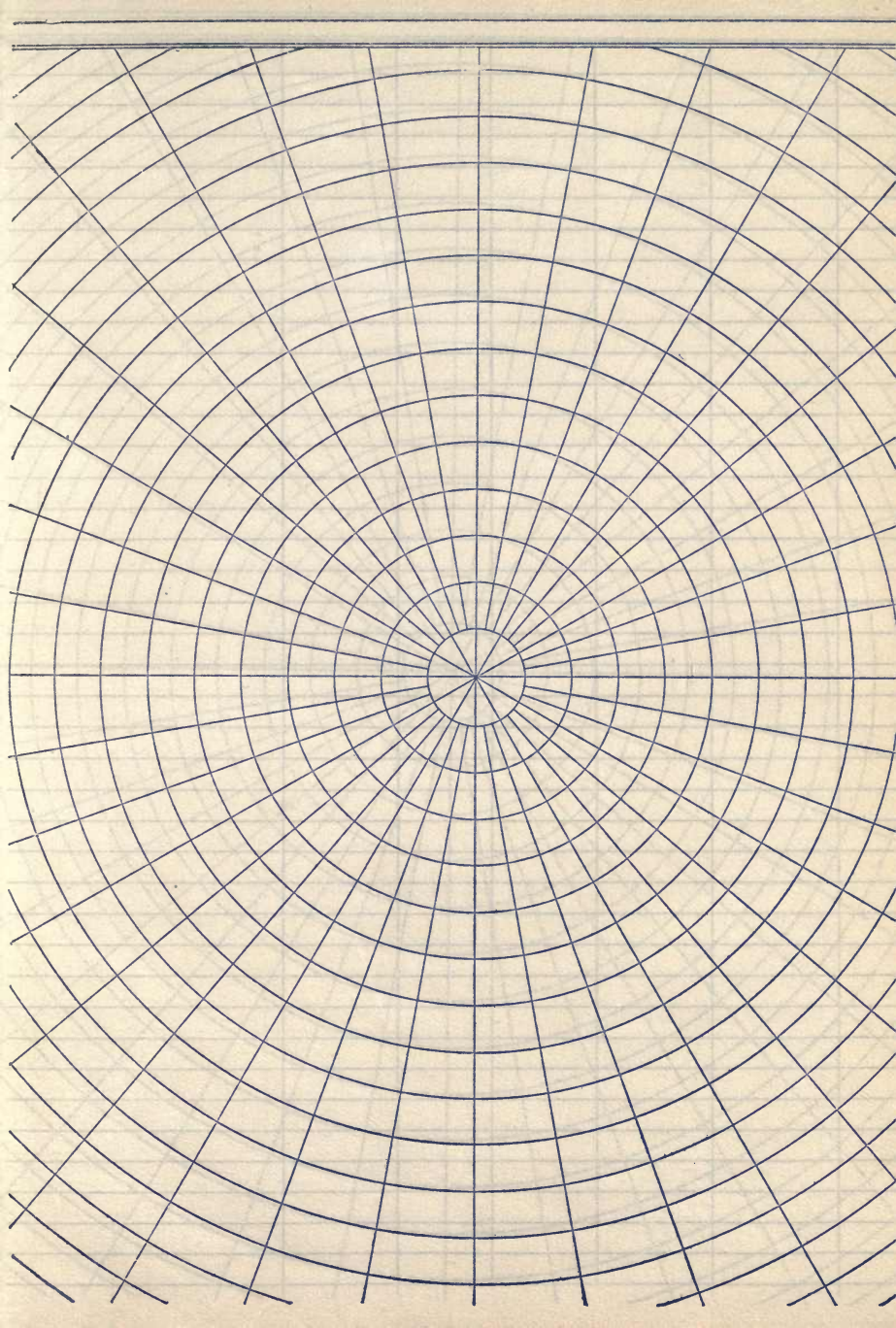


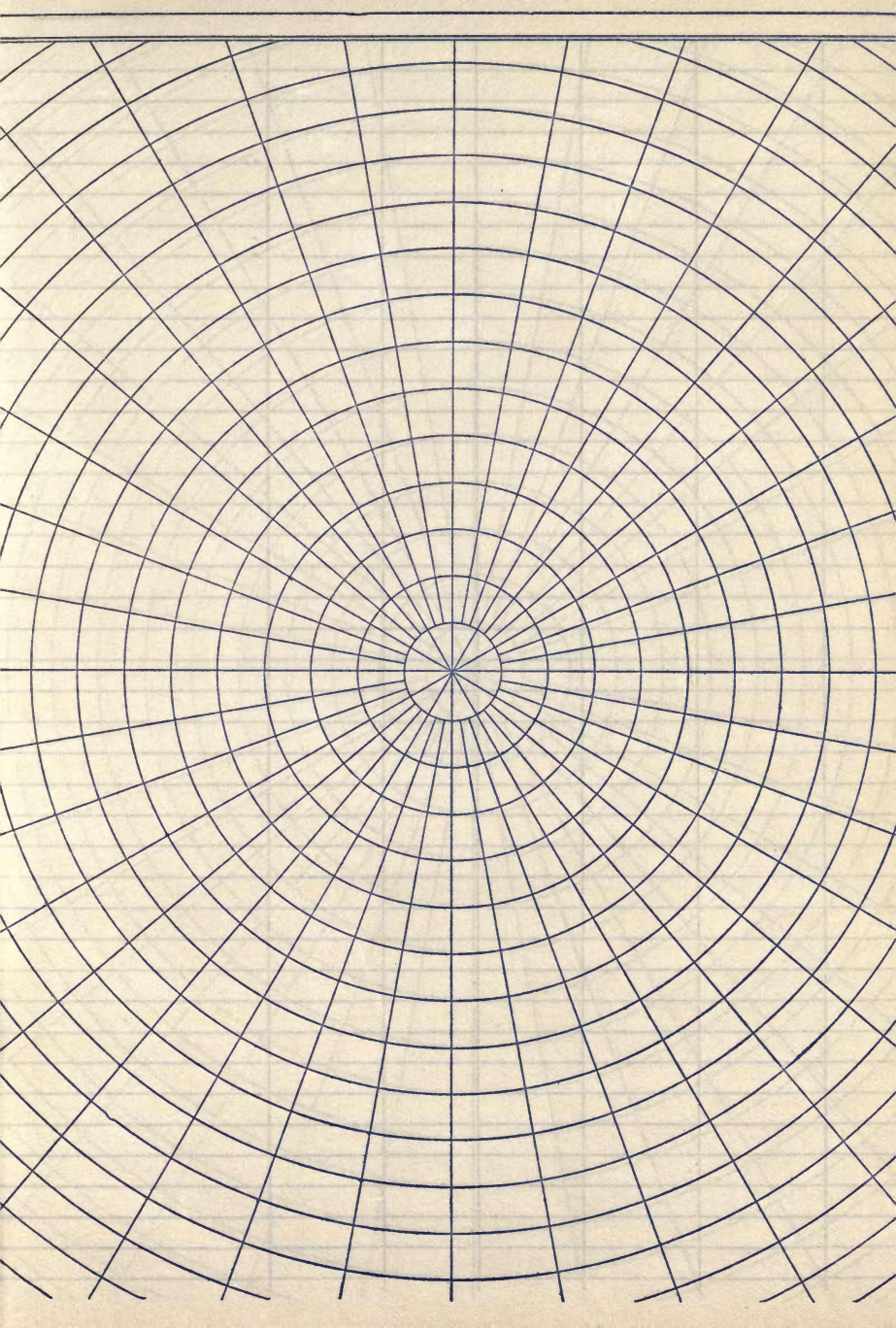


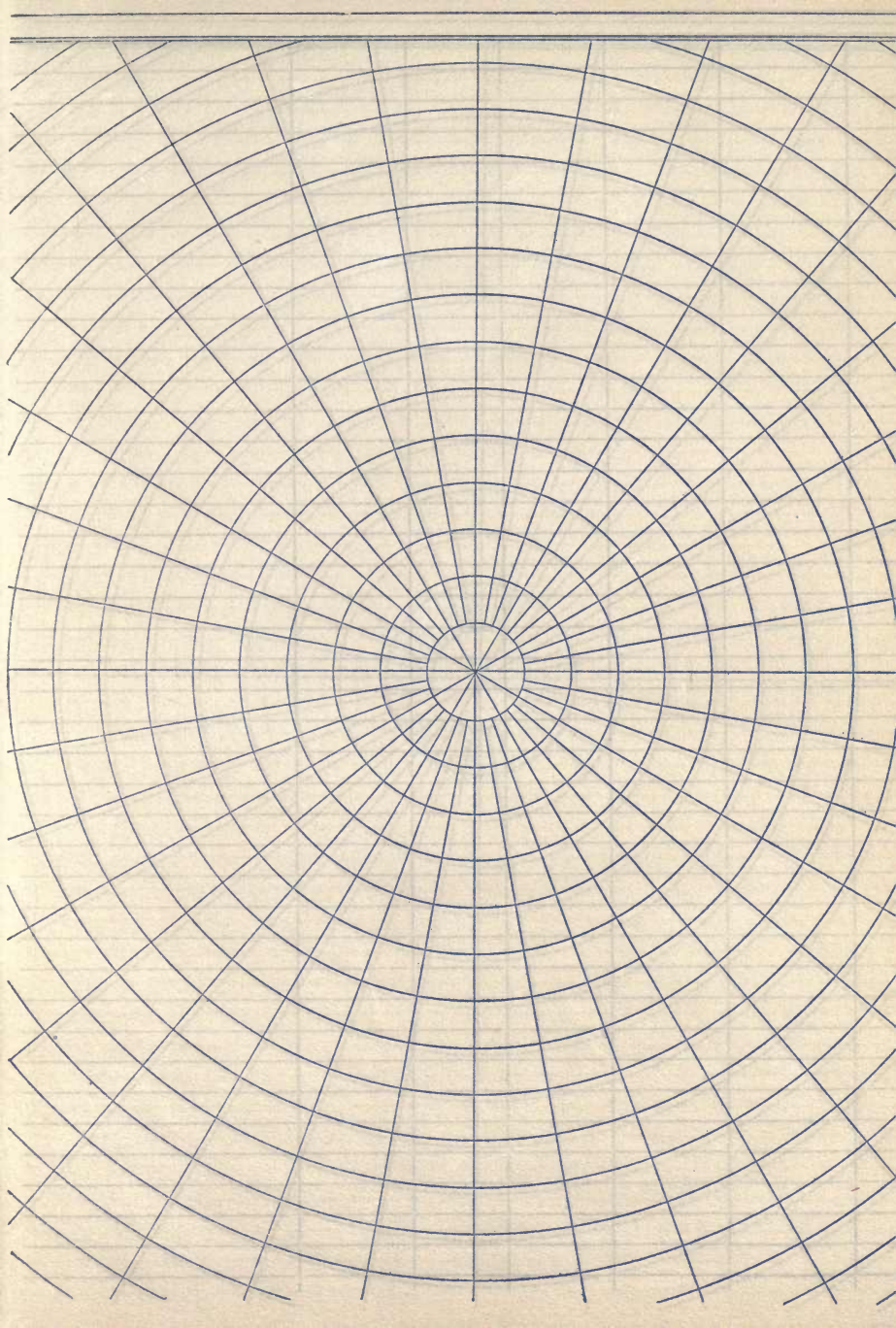


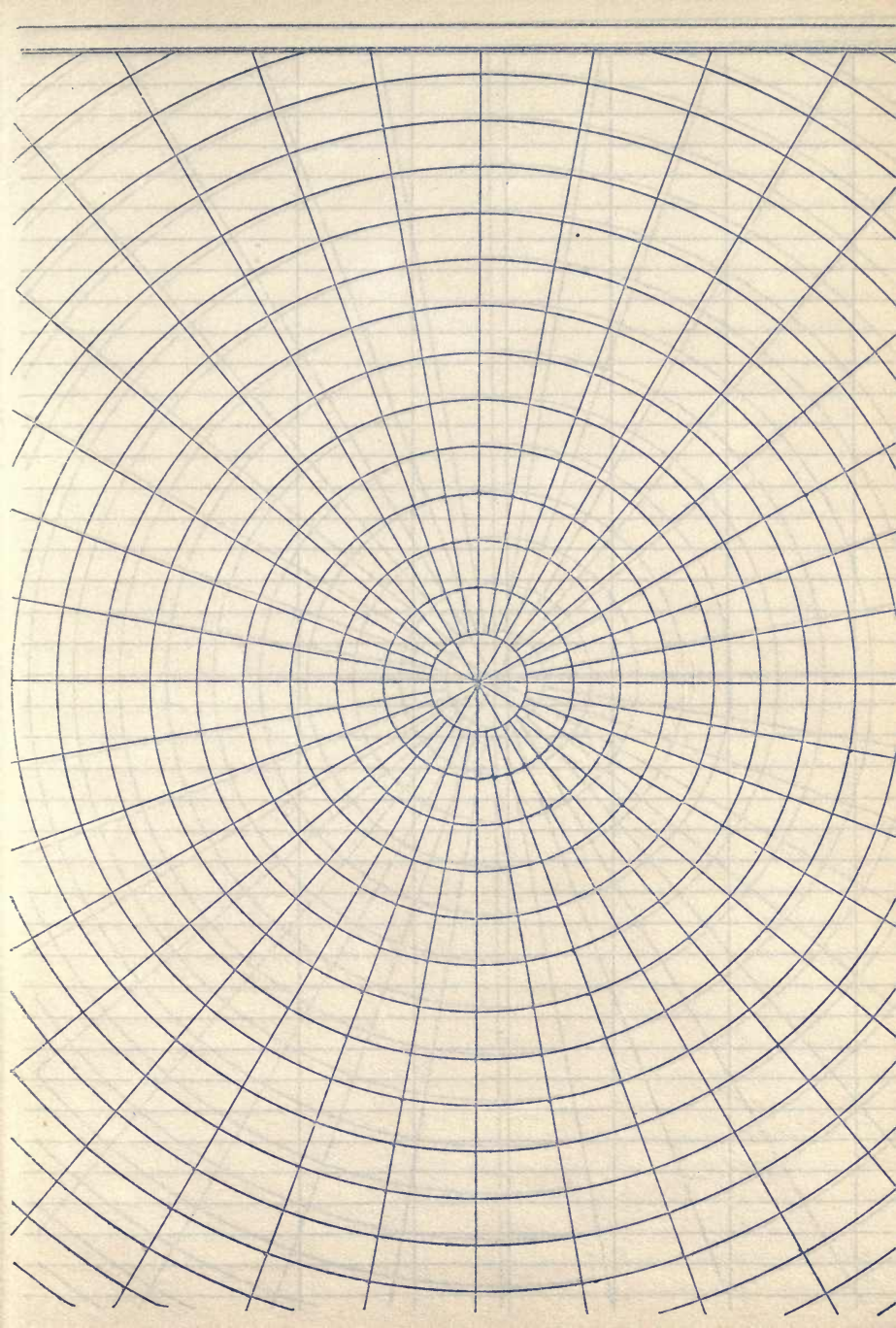


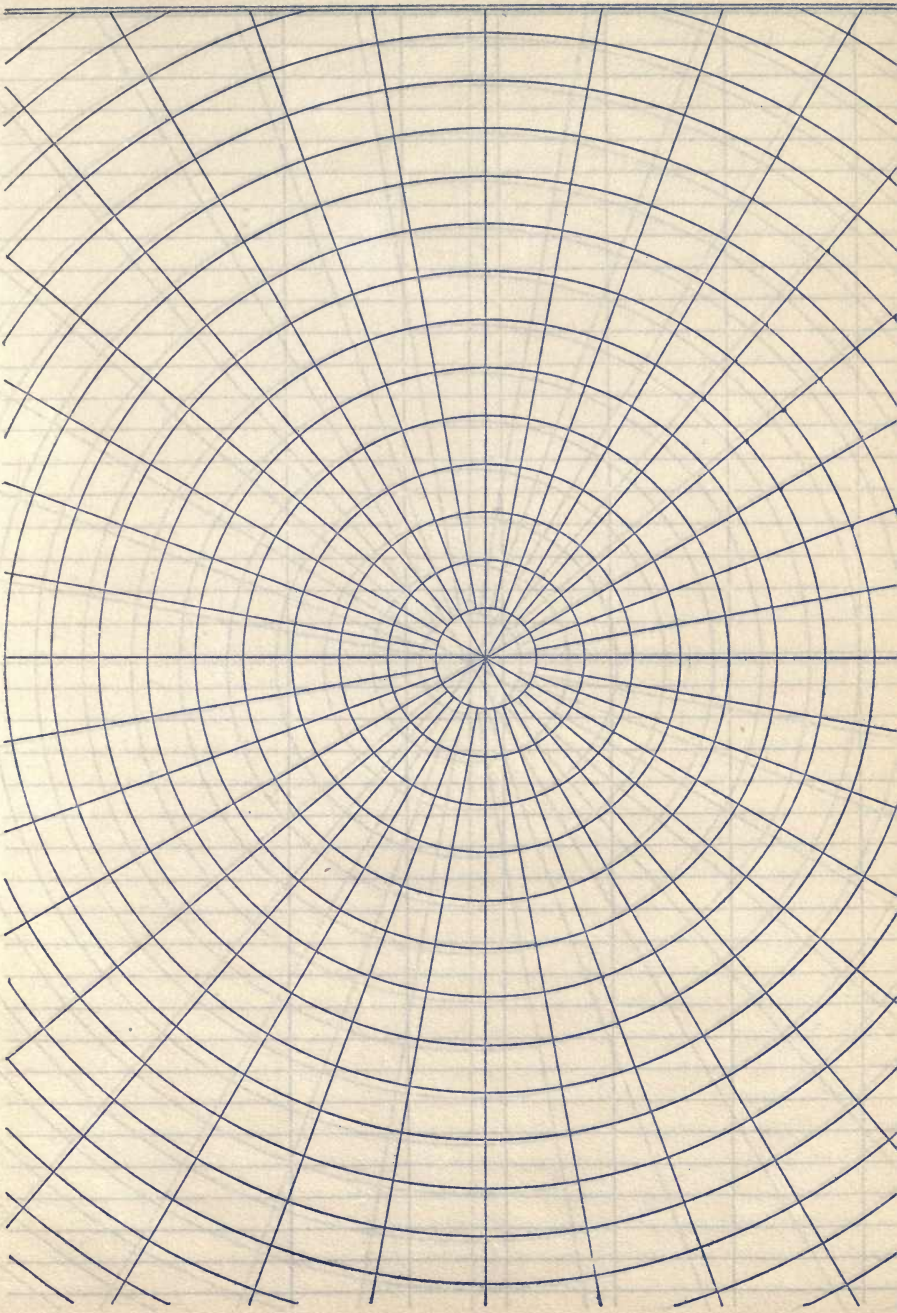


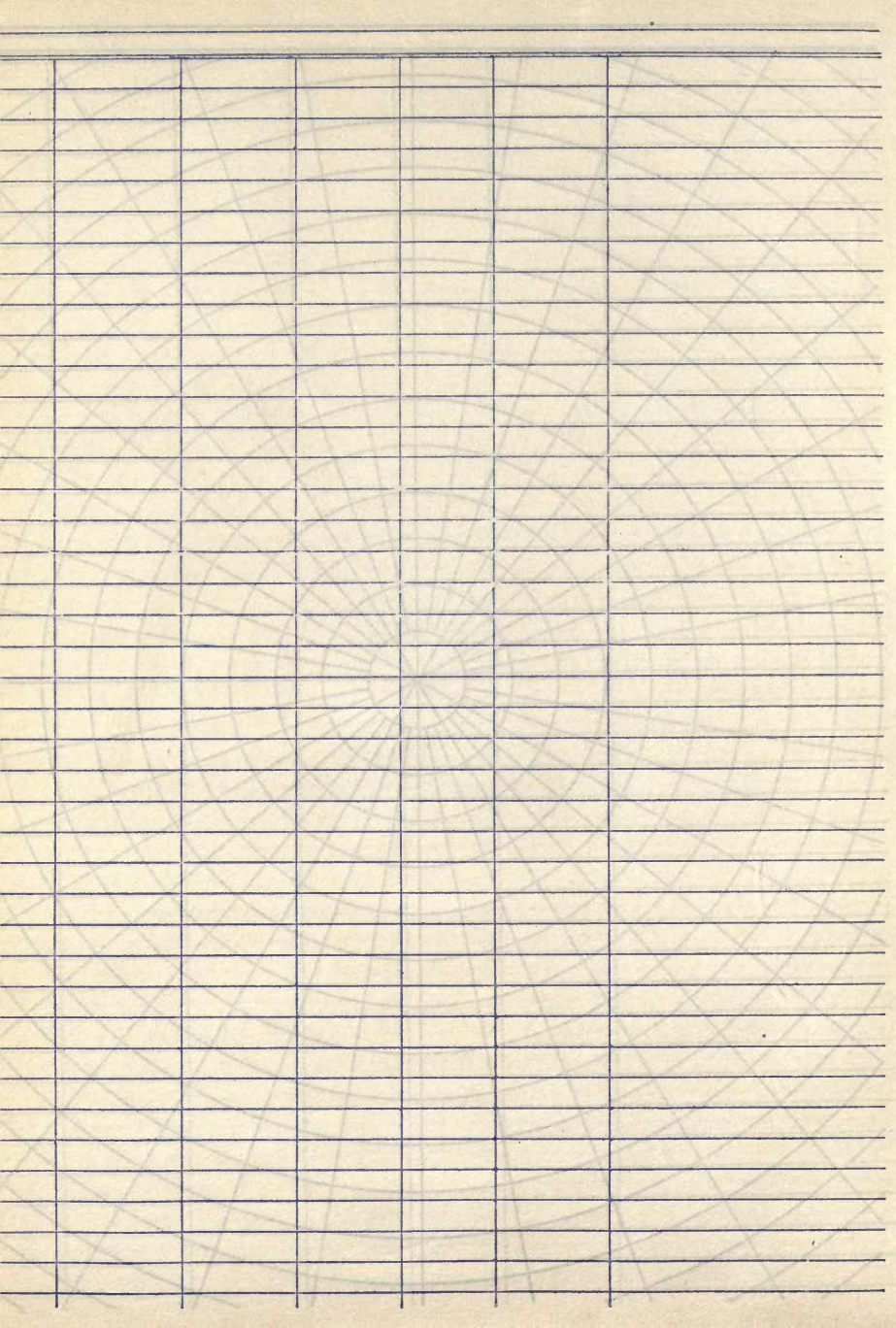


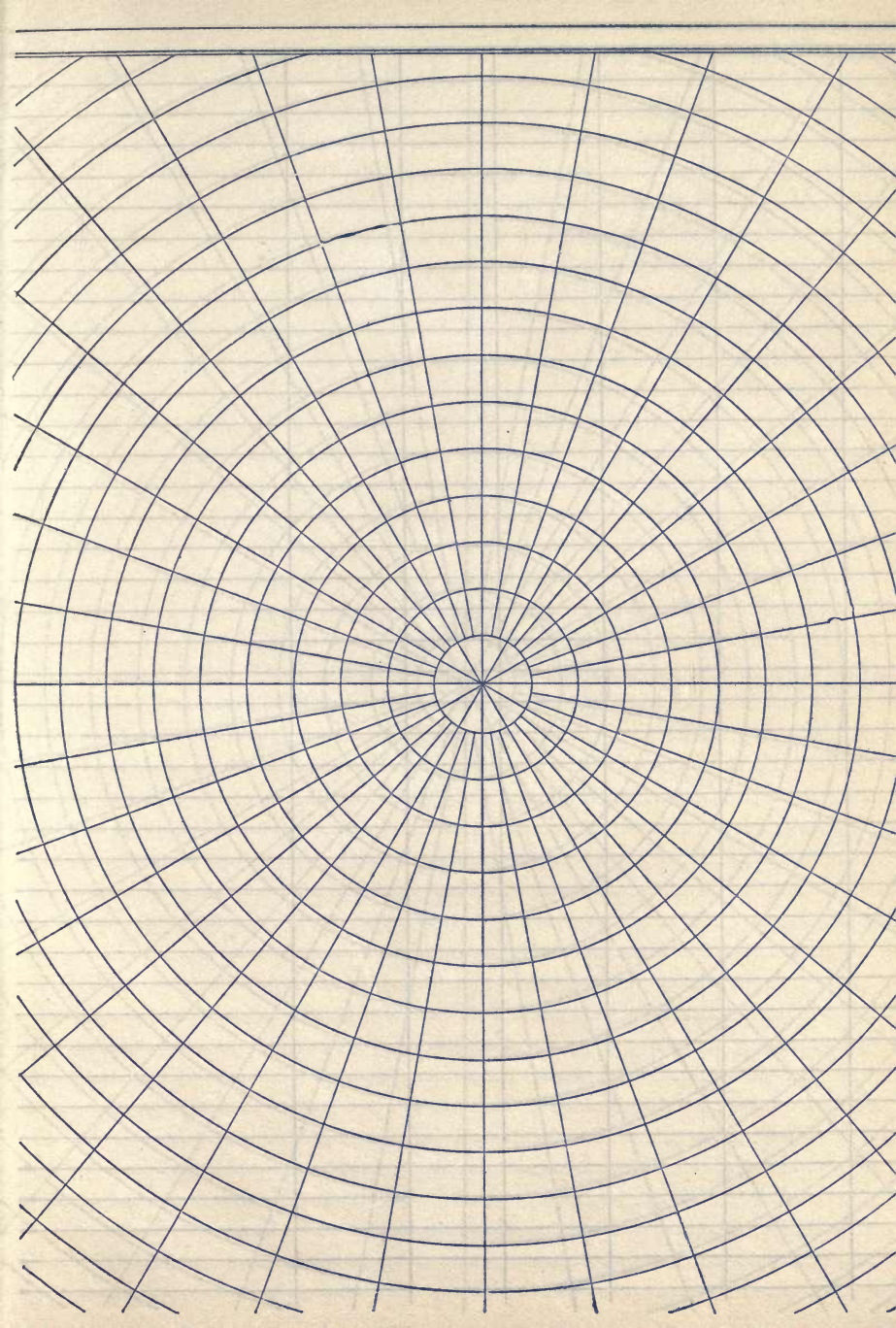


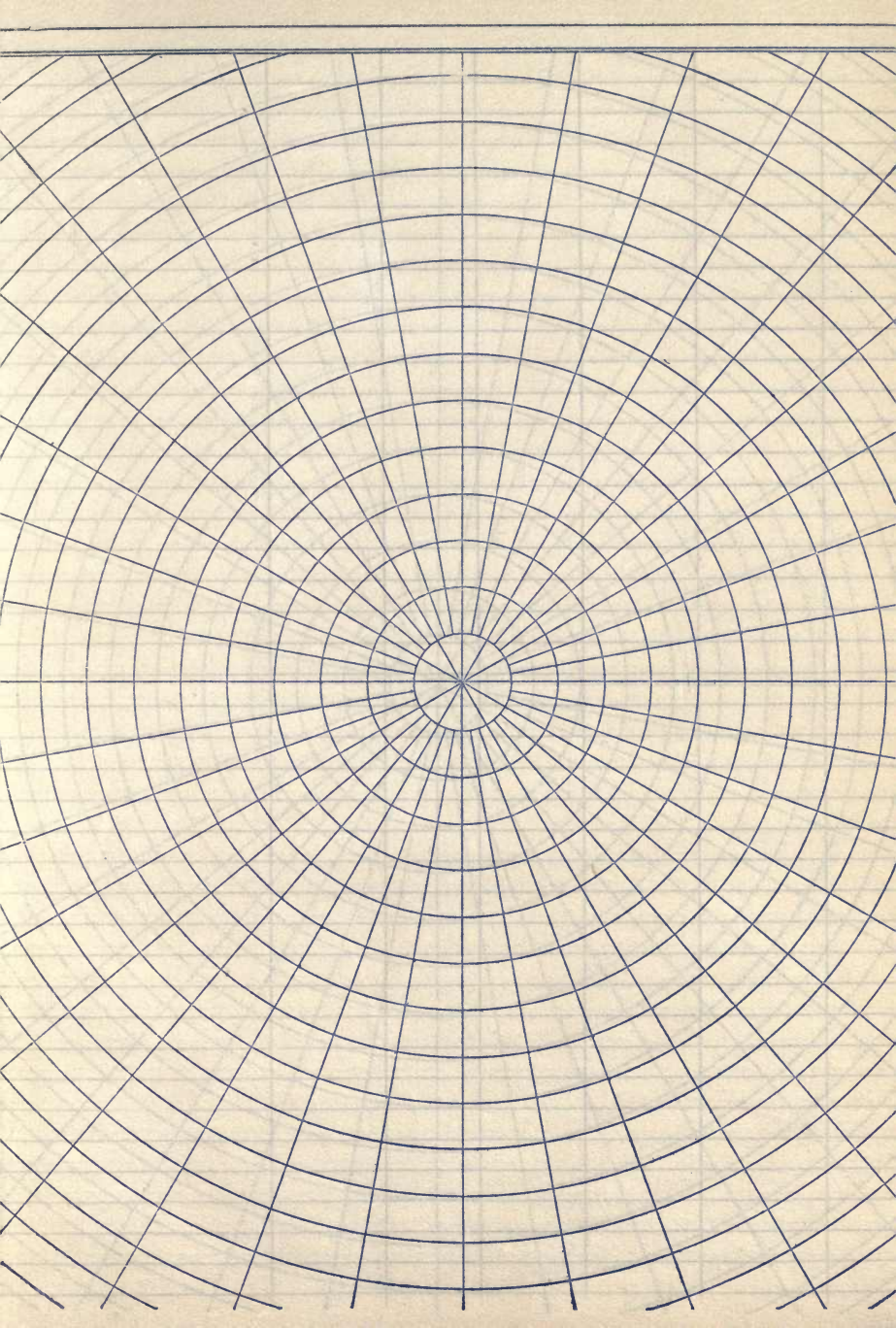


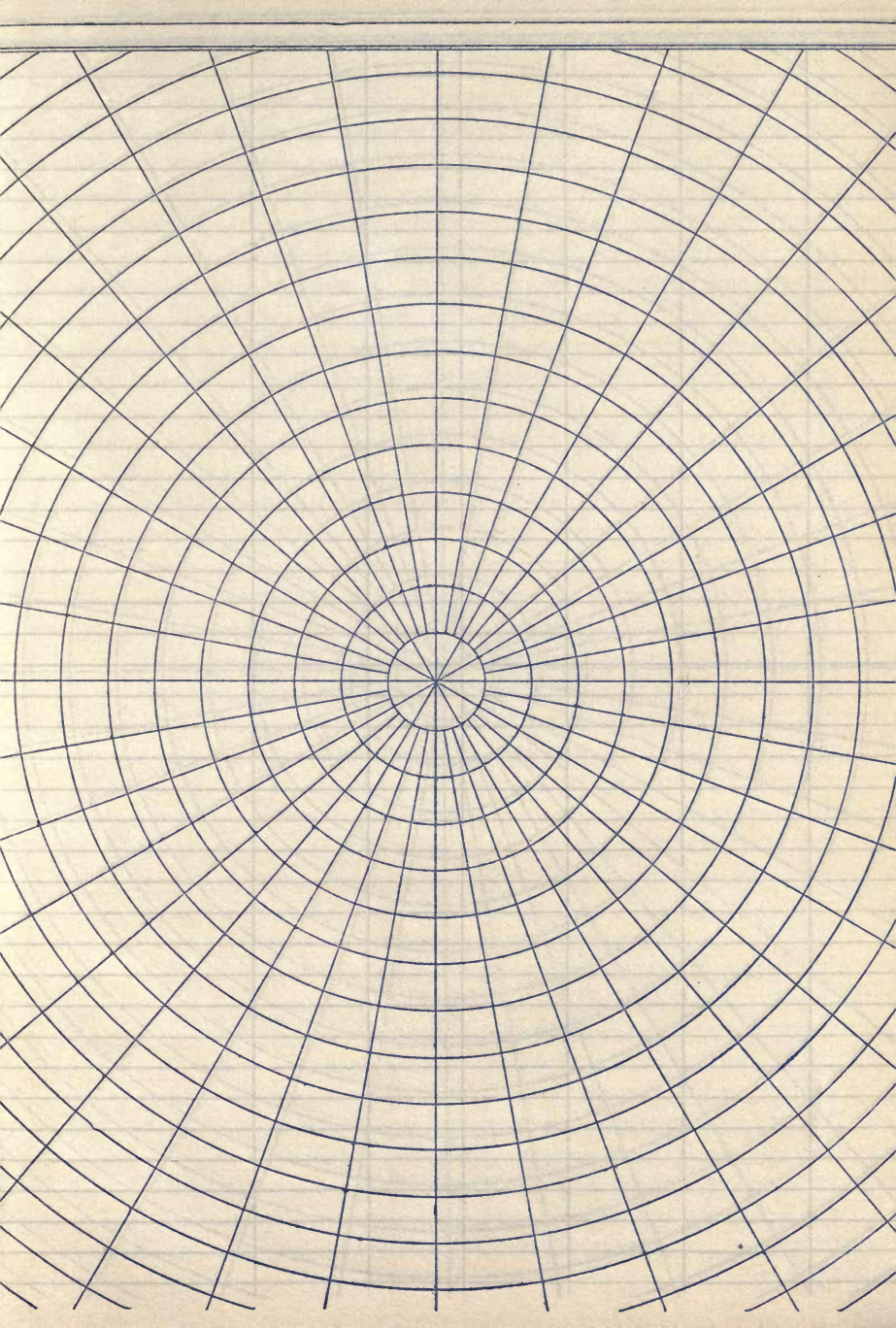


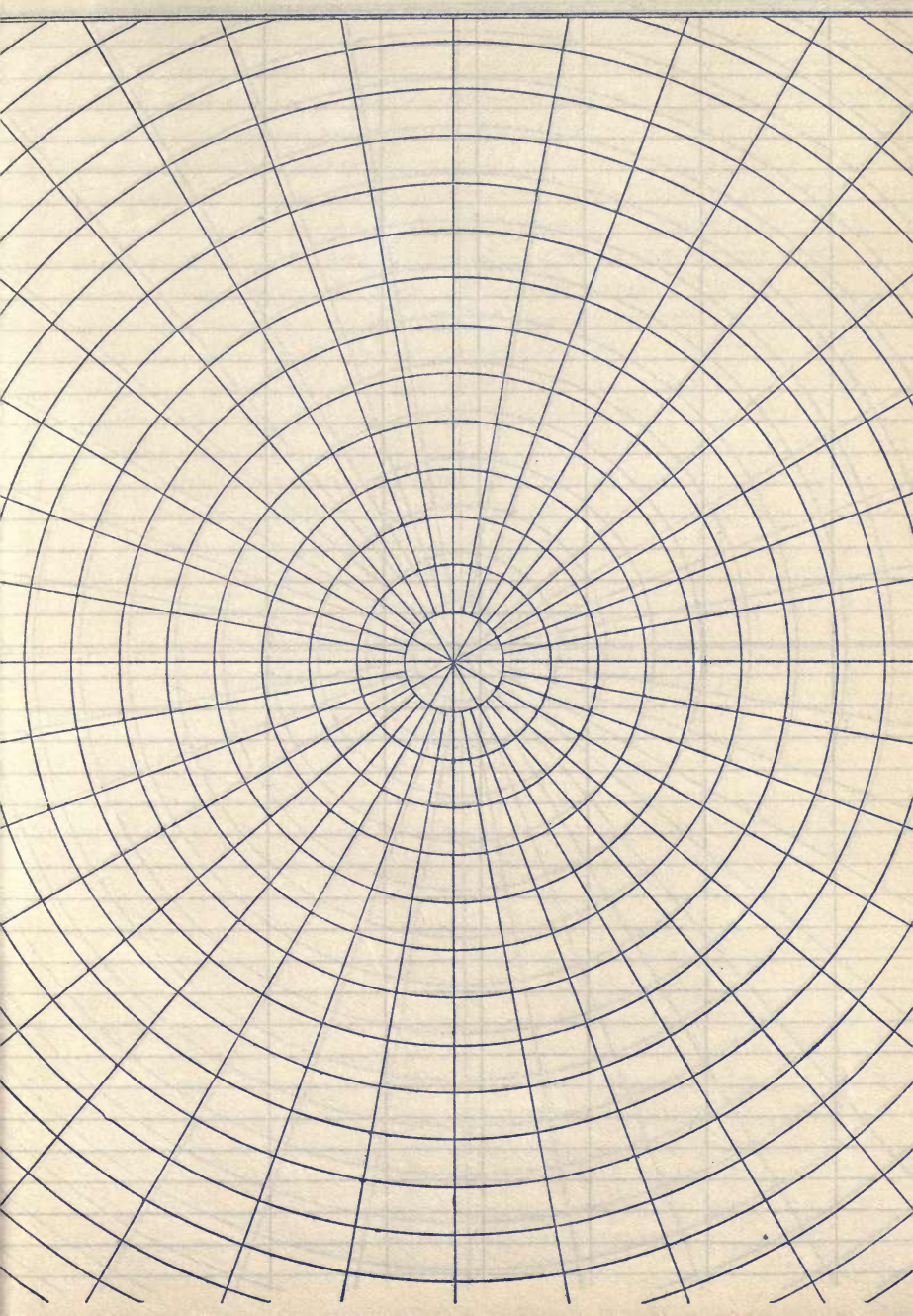


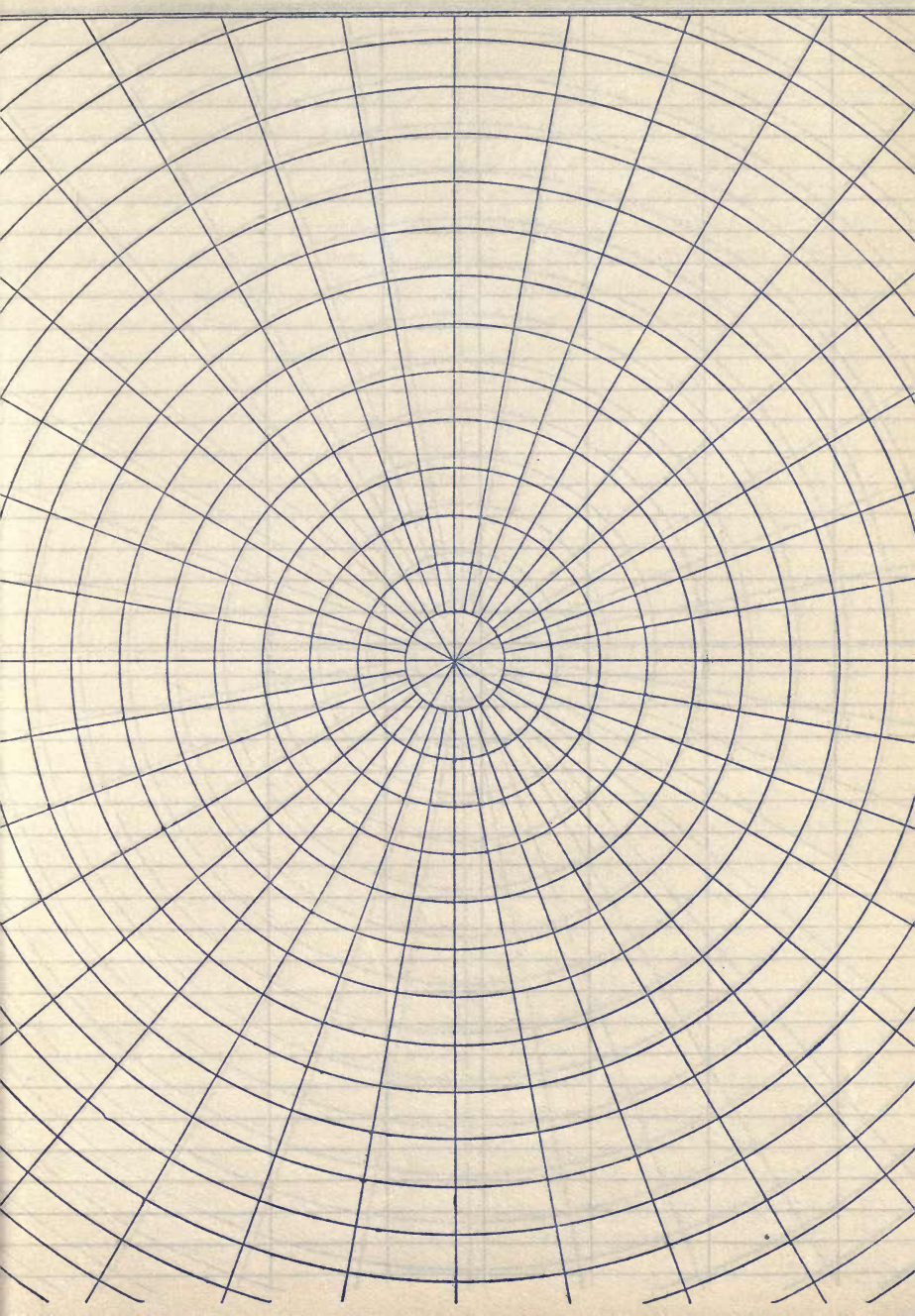


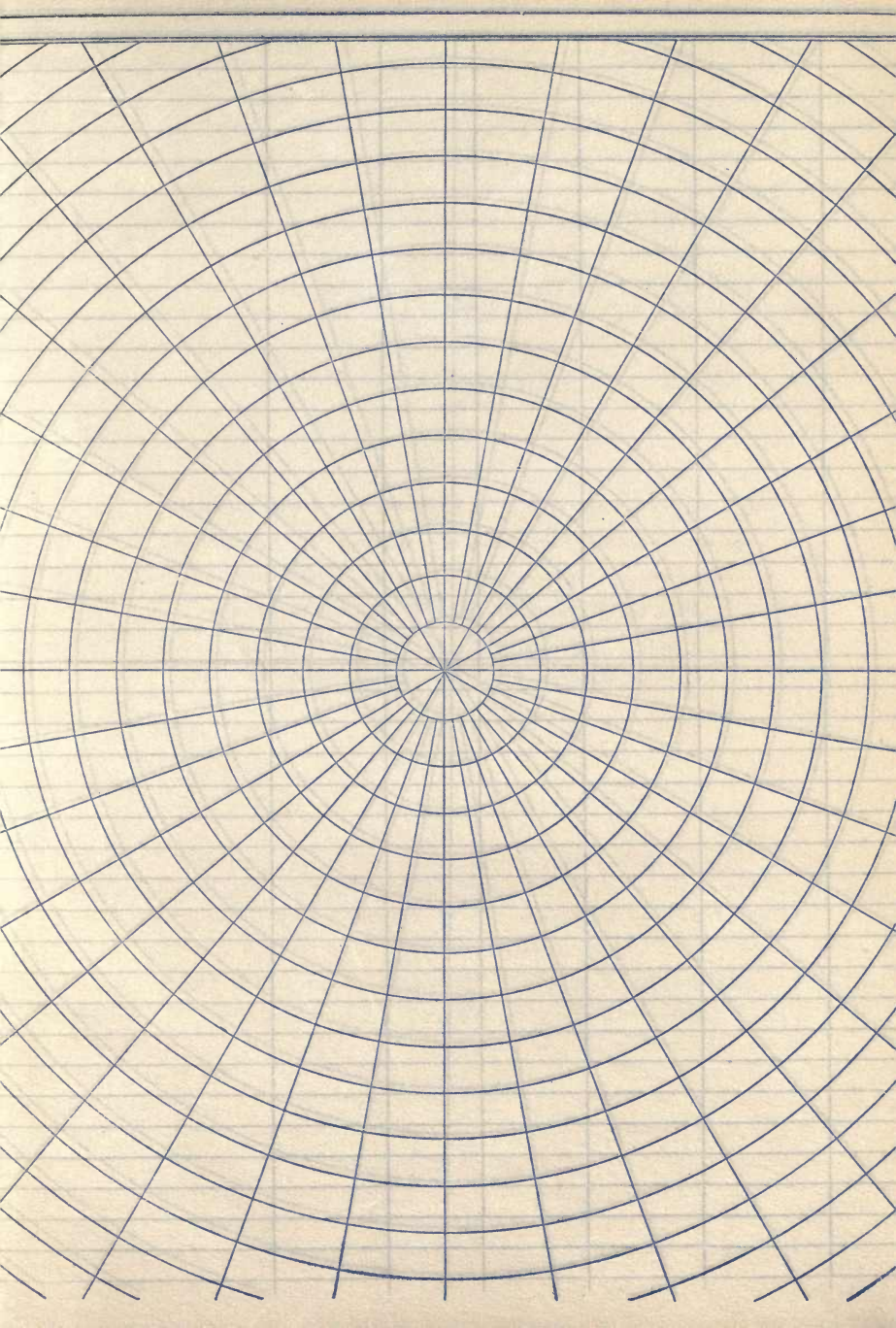


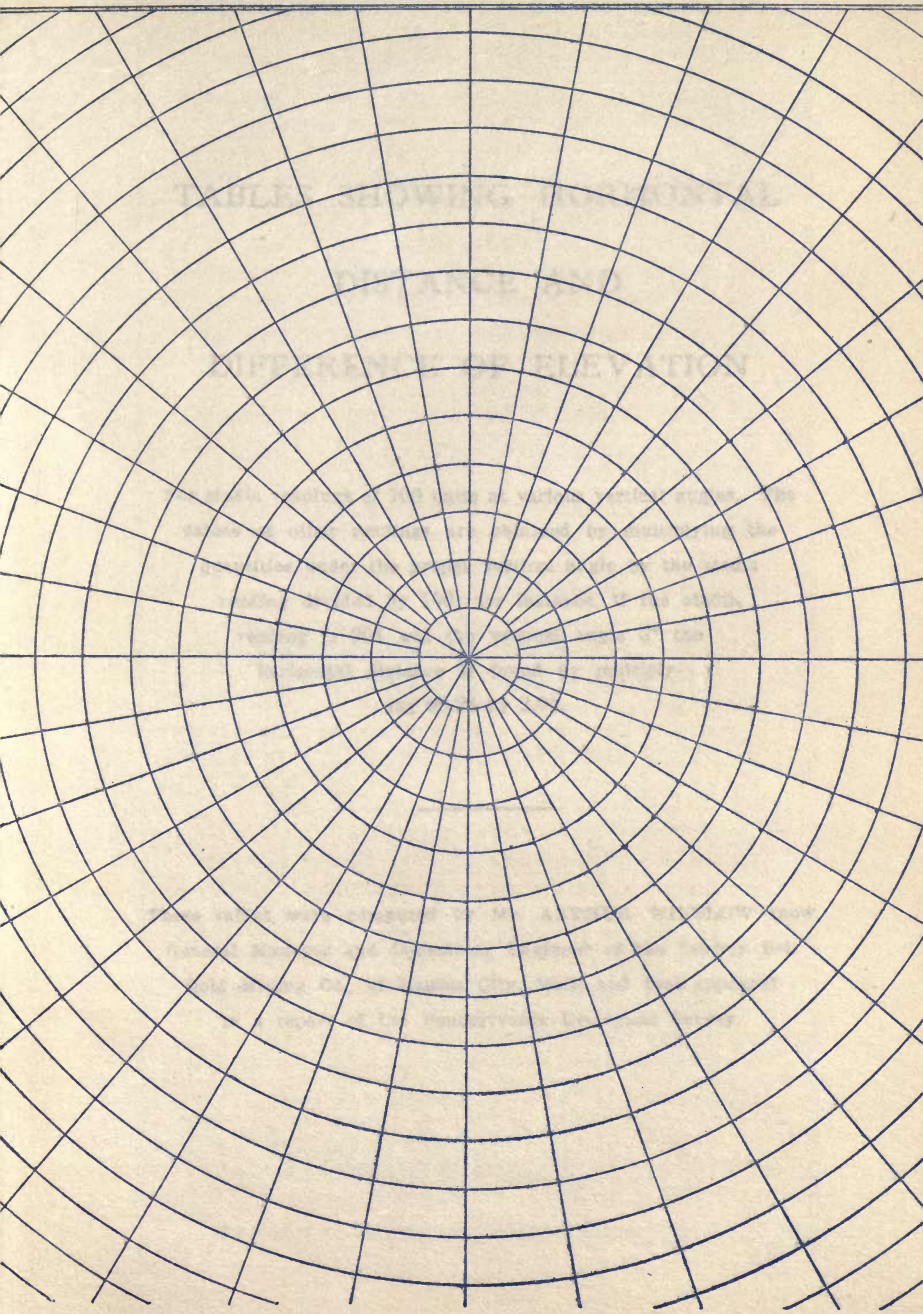


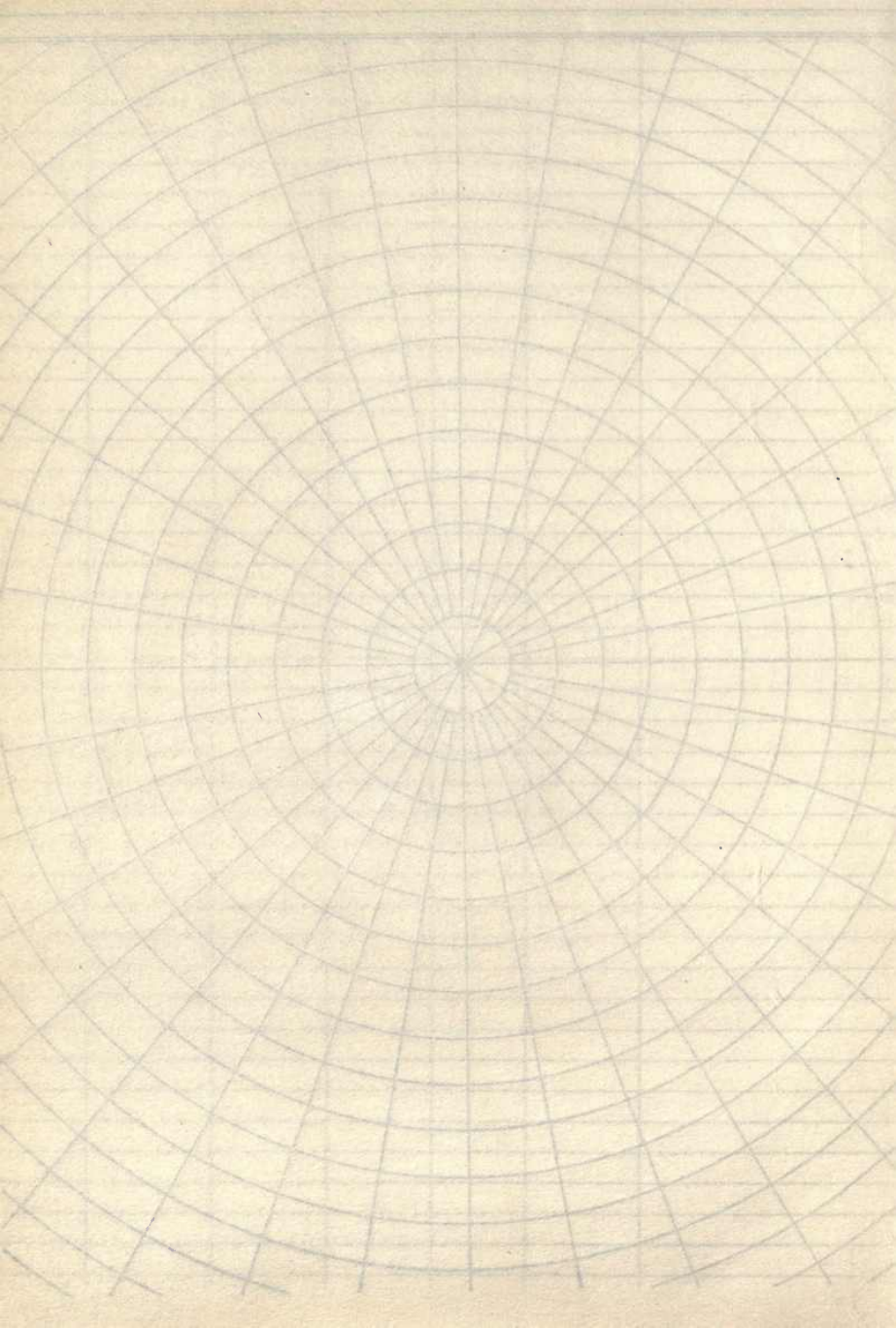












TABLES SHOWING HORIZONTAL DISTANCE AND DIFFERENCE OF ELEVATION

For stadia readings of 100 units at various vertical angles. The values of other readings are obtained by multiplying the quantities under the proper vertical angle by the stadia reading divided by 100; for instance, if the stadia reading is 204 and the vertical angle 5° the horizontal distance is found by multiplying 99.24 by 2.04.

These tables were computed by Mr. ARTHUR WINSLOW (now General Manager and Consulting Engineer of the Liberty Bell Gold Mining Co., of Kansas City, Mo.), and first appeared in a report of the Pennsylvania Geological Survey.

M.	0°		1°		2°		3°		4°		5°		6°		7°		8°		9°		10°	
′	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.
0	100.00	0.00	99.97	1.74	99.88	3.49	99.73	5.23	99.51	6.96	99.24	8.68	98.91	10.40	98.51	12.10	98.06	13.78	97.55	15.45	96.98	17.10
2	100.00	0.06	99.97	1.80	99.87	3.55	99.72	5.28	99.51	7.02	99.23	8.74	98.90	10.45	98.50	12.15	98.05	13.84	97.53	15.51	96.96	17.16
4	100.00	0.12	99.97	1.86	99.87	3.60	99.71	5.34	99.50	7.07	99.22	8.80	98.88	10.51	98.48	12.21	98.03	13.89	97.52	15.56	96.94	17.21
6	100.00	0.17	99.96	1.92	99.87	3.66	99.71	5.40	99.49	7.13	99.21	8.85	98.87	10.57	98.47	12.26	98.01	13.95	97.50	15.62	96.92	17.26
8	100.00	0.23	99.96	1.98	99.86	3.72	99.70	5.46	99.48	7.19	99.20	8.91	98.86	10.62	98.46	12.32	98.00	14.01	97.48	15.67	96.90	17.32
10	100.00	0.29	99.96	2.04	99.86	3.78	99.69	5.52	99.47	7.25	99.19	8.97	98.85	10.68	98.44	12.38	97.98	14.06	97.46	15.73	96.88	17.37
12	100.00	0.35	99.96	2.09	99.85	3.84	99.69	5.57	99.46	7.30	99.18	9.03	98.83	10.74	98.43	12.43	97.97	14.12	97.44	15.78	96.86	17.43
14	100.00	0.41	99.95	2.15	99.85	3.90	99.68	5.63	99.46	7.36	99.17	9.08	98.82	10.79	98.41	12.49	97.95	14.17	97.43	15.84	96.84	17.48
16	100.00	0.47	99.95	2.21	99.84	3.95	99.68	5.69	99.45	7.42	99.16	9.14	98.81	10.85	98.40	12.55	97.93	14.23	97.41	15.89	96.82	17.54
18	100.00	0.52	99.95	2.27	99.84	4.01	99.67	5.75	99.44	7.48	99.15	9.20	98.80	10.91	98.39	12.60	97.92	14.28	97.39	15.95	96.80	17.59
20	100.00	0.58	99.95	2.33	99.83	4.07	99.66	5.80	99.43	7.53	99.14	9.25	98.78	10.96	98.37	12.66	97.90	14.34	97.37	16 00	96.78	17.65
22	100.00	0.64	99.94	2.38	99.83	4.13	99.66	5.86	99.42	7.59	99.13	9.31	98.77	11.02	98.36	12.72	97.88	14.40	97.35	16.06	96.76	17.70
24	100.00	0.70	99.94	2.44	99.82	4.18	99.65	5.92	99.41	7.65	99.11	9.37	98.76	11.08	98.34	12.77	97.87	14.45	97.33	16.11	96.74	17.76
26	99.99	0.76	99.94	2.50	99.82	4.24	99.64	5.98	99.40	7.71	99.10	9.43	98.74	11.13	98.33	12.83	97.85	14.51	97.31	16.17	96.72	17.81
28	99.99	0.81	99.93	2.56	99.81	4.30	99.63	9.04	99.39	7.76	99.09	9.48	98.73	11.19	98.31	12.88	97.83	14.56	97.29	16.22	96.70	17.86
30	99.99	0.87	99.93	2.62	99.81	4.36	99.63	9.09	99.38	7.82	99.08	9.54	98.72	11.25	98.29	12.94	97.82	14.62	97.28	16.28	96.68	17.92
32	99.99	0.93	99.93	2.67	99.80	4.42	99.62	6.15	99.38	7.88	99.07	9.60	98.71	11.30	98.28	13.00	97.80	14.67	97.26	16.33	96.66	17.97
34	99.99	0.99	99.93	2.73	99.80	4.48	99.62	6.21	99.37	7.94	99.06	9.65	98.69	11.36	98.27	13.05	97.78	14.73	97.24	16.39	96.64	18.03
36	99.99	1.05	99.92	2.79	99.79	4.53	99.61	6.27	99.36	7.99	99.05	9.71	98.68	11.42	98.25	13.11	97.76	14.79	97.22	16.44	96.62	18.08
38	99.99	1.11	99.92	2.85	99.79	4.59	99.60	6.33	99.35	8.05	99.04	9.77	98.67	11.47	98.24	13.17	97.75	14.84	97.20	16.50	96.60	18.14
40	99.99	1.16	99.92	2.91	99.78	4.65	99.59	6.38	99.34	8.11	99.03	9.83	98.65	11.53	98.22	13.22	97.73	14.90	97.18	16.55	96.57	18.19
42	99.99	1.22	99.91	2.97	99.78	4.71	99.59	6.44	99.33	8.17	99.01	9.88	98.64	11.59	98.20	13.28	97.71	14.95	97.16	16.61	96.55	18.24
44	99.98	1.28	99.91	3.02	99.77	4.76	99.58	6.50	99.32	8.22	99.00	9.94	98.63	11.64	98.19	13.33	97.69	15.01	97.14	16.66	96.53	18.30
46	99.98	1.34	99.90	3.08	99.77	4.82	99.57	6.56	99.31	8.28	98.99	10.00	98.61	11.70	98.17	13.39	97.68	15.06	97.12	16.72	96.51	18.35
48	99.98	1.40	99.90	3.14	99.76	4.88	99.56	6.61	99.30	8.34	98.98	10.05	98.60	11.76	98.16	13.45	97.66	15.12	97.10	16.77	96.49	18.41
50	99.98	1.45	99.90	3.20	99.76	4.94	99.56	6.67	99.29	8.40	98.97	10.11	98.58	11.81	98.14	13.50	97.64	15.17	97.08	16.83	96.47	18.46
52	99.98	1.51	99.89	3.26	99.75	4.99	99.55	6.73	99.28	8.45	98.96	10.17	98.57	11.87	98.13	13.56	97.62	15.23	97.06	16.88	96.45	18.51
54	99.98	1.57	99.89	3.31	99.74	5.05	99.54	6.78	99.27	8.51	98.94	10.22	98.56	11.93	98.11	13.61	97.61	15.28	97.04	16.94	96.42	18.57
56	99.97	1.63	99.89	3.37	99.74	5.11	99.53	6.84	99.26	8.57	98.93	10.28	98.54	11.98	98.10	13.67	97.59	15.34	97.02	16.99	96.40	18.62
58	99.97	1.69	99.88	3.43	99.73	5.17	99.52	6.90	99.25	8.63	98.92	10.34	98.53	12.04	98.08	13.73	97.57	15.40	97.00	17.05	96.38	18.63
c=0.75	0.75	0.01	0.75	0.02	0.75	0.03	0.75	0.05	0.75	0.06	0.75	0.07	9.75	0.08	0.74	0.10	0.74	0.11	0.74	0.12	0.74	0.14
c=1.00	1.00	0.01	1.00	0.03	1.00	0.04	1.00	0.06	1.00	0.08	0.99	0.09	0.99	0.11	0.99	0.13	0.99	0.15	0.99	0.16	0.98	0.18
c=1.25	1.25	0.02	1.25	0.03	1.25	0.05	1.25	0.08	1.25	0.10	1.24	0.11	1.24	0.14	1.24	0.16	1.23	0.18	1.23	0.21	1.23	0.23

M.	11°		12°		13°		14°		15°		16°		17°		18°		19°		20°	
`	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.
0	96.36	18.73	95.68	20.34	94.94	21.92	94.15	23.47	93.30	25.00	92.40	26.50	91.45	27.96	90.45	29.39	89.40	30.78	88.30	32.14
2	96.34	18.78	95.65	20.39	94.91	21.97	94.12	23.52	93.27	25.05	92.37	26.55	91.42	28.01	90.42	29.44	89.36	30.83	88.26	32.18
4	96.32	18.84	95.63	20.44	94.89	22.02	94.09	23.58	93.24	25.10	92.34	26.59	91.39	28.06	90.38	29.48	89.33	30.87	88.23	32.23
6	96.29	18.89	95.61	20.50	94.86	22.08	94.07	23.63	93.21	25.15	92.31	26.64	91.35	28.10	90.35	29.53	89.29	30.92	88.19	32.27
8	96.27	18.95	95.58	20.55	94.84	22.13	94.04	23.68	93.18	25.20	92.28	26.69	91.32	28.15	90.31	29.58	89.26	30.97	88.15	32.32
10	96.25	19.00	95.56	20.60	94.81	22.18	94.01	23.73	93.16	25.25	92.25	26.74	91.29	28.20	90.28	29.62	89.22	31.01	88.11	32.36
12	96.23	19.05	95.53	20.66	94.79	22.23	93.98	23.78	93.13	25.30	92.22	26.79	91.26	28.25	90.24	29.67	89.18	31.06	88.08	32.41
14	96.21	19.11	95.51	20.71	94.76	22.28	93.95	23.83	93.10	25.35	92.19	26.84	91.22	28.30	90.21	29.72	89.15	31.10	88.04	32.45
16	96.18	19.16	95.49	20.76	94.73	22.34	93.93	23.88	93.07	25.40	92.15	26.89	91.19	28.34	90.18	29.76	89.11	31.15	88.00	32.49
18	96.16	19.21	95.46	20.81	94.71	22.39	93.90	23.93	93.04	25.45	92.12	26.94	91.16	28.39	90.14	29.81	89.08	31.19	87.96	32.54
20	96.14	19.27	95.44	20.87	94.68	22.44	93.87	23.99	93.01	25.50	92.09	26.99	91.12	28.44	90.11	29.86	89.04	31.24	87.93	32.58
22	96.12	19.32	95.41	20.92	94.66	22.49	93.84	24.04	92.98	25.55	92.06	27.04	91.09	28.49	90.07	29.90	89.00	31.28	87.89	32.63
24	96.09	19.38	95.39	20.97	94.63	22.54	93.81	24.09	92.95	25 60	92.03	27.09	91.06	28.54	90.04	29.95	88.96	31.33	87.85	32.67
26	96.07	19.43	95.36	21.03	94.60	22.60	93.79	24.14	92.92	25.65	92.00	27.13	91.02	28.58	90.00	30.00	88.93	31.38	87.81	32.72
28	96.05	19.48	95.34	21.08	94.58	22.65	93.76	24.19	92.89	25.70	91.97	27.18	90.99	28.63	89.97	30.04	88.89	31.42	87.77	32.76
30	96.03	19.54	95.32	21.13	94.55	22.70	93.73	24.24	92.86	25.75	91.93	27.23	90.96	28.68	89.93	30.09	88.86	31.47	87.74	32.80
32	96.00	19.59	95.29	21.18	94.52	22.75	93.70	24.29	92.83	25.80	91.90	27.28	90.92	28.73	89.90	30.14	88.82	31.51	87.70	32.85
34	95.98	19.64	95.27	21.24	94.50	22.80	93.67	24.34	92.80	25.85	91.87	27.33	90.89	28.77	89.86	30.19	88.78	31.56	87.66	32.89
36	95.96	19.70	95.24	21.29	94.47	22.85	93.65	24.39	92.77	25.90	91.84	27.38	90.86	28 82	89.83	30.23	88.75	31.60	87.62	32.93
38	95.93	19.75	95.22	21.34	94.44	22.91	93.62	24.44	92.74	25.95	91.81	27.43	90.82	28.87	89.79	30.28	88.71	31.65	87.58	32.98
40	95.91	19.80	95.19	21.39	94.42	22.96	93.59	24.49	92.71	26.00	91.77	27.48	90.79	28.92	89.76	30.32	88.67	31.69	87.54	33.02
42	95.89	19.86	95.17	21.45	94.39	23.01	93.56	24 55	92.68	26.05	91.74	27.52	90.76	28.96	89.72	30.37	88.64	31.74	87.51	33.07
44	95.86	19.91	95.14	21.50	94.36	23.06	93.53	24.60	92.65	26.10	91.71	27.57	90.72	29.01	89.69	30.41	88.60	31.78	87.47	33.11
46	95.84	19.96	95.12	21.55	94.34	23.11	93.50	24.65	92.62	26.15	91.68	27.62	90.69	29.06	89.65	30.46	88.56	31.83	87.43	33.15
48	95.82	20.02	95.09	21.60	94.31	23.16	93.47	24.70	92.59	26.20	91.65	27.67	90.66	29.11	89.61	30.51	88.53	31.87	87.39	33.20
50	95.79	20.07	95.07	21.66	94.28	23.22	93.45	24.75	92.56	26.25	91.61	27.72	90.62	29.15	89.58	30.55	88.49	31.92	87.35	33.24
52	95.77	20.12	95.04	21.71	94.26	23.27	93.42	24.80	92.53	26.30	91.58	27.77	90.59	29.20	89.54	30.60	88.45	31.96	87.31	33.28
54	95.75	20.18	95.02	21.76	94.23	23.32	93.39	24.85	92.49	26.35	91.55	27.81	90.55	29.25	89.51	30.65	88.41	32.01	87.27	33 33
56	95.72	20.23	94.99	21.81	94.20	23.37	93.36	24.90	92.46	26.40	91.52	27.86	90.52	29.30	89.47	30.69	88.38	32.05	87.24	33.37
58	95.70	20.28	94.97	21.87	94.17	23.42	93.33	24 95	92.43	26.45	91.48	27.91	90.48	29.34	89.44	30.74	88.34	32.09	87.20	33.41
c=0.75	0.73	0.15	0.73	0.16	0.73	0.17	0.73	0.19	0.72	0.20	0.72	0.21	0.72	0.23	0.71	0.24	0.71	0.25	0.70	0.26
c=1.00	0.98	0.20	0.98	0.22	0.97	0.23	0.97	0.25	0.96	0 27	0.96	0.28	0.95	0.30	0.95	0.32	0.94	0.33	0.94	0.35
c=1.25	1.22	0.25	1.22	0.27	1.21	0.29	1.21	0.31	1.20	0.34	1.20	0.36	1.19	0.38	1.19	0 40	1.18	0.42	1.17	0 44

91 LIBRARY OF THE

M.	21°		22°		23°		24°		25°		26°		27°		28°		29°		30°	
'	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.
0	87.16	33.46	85.97	34.73	84.73	35.97	83.46	37.16	82.14	38.30	80.78	39.40	79.39	40.45	77.96	41.45	76.50	42.40	75.00	43.30
2	87.12	33.50	85.93	34.77	84.69	36.01	83.41	37.20	82.09	38.34	80.74	39.44	79.34	40.49	77.91	41.48	76.45	42.43	74.95	43.33
4	87.08	33.54	85.89	34.82	84.65	36.05	83.37	37.23	82.05	38.38	80.69	39.47	79.30	40.52	77.86	41.52	76.40	42.46	74.90	43.36
6	87.04	33.59	85.85	34.86	84.61	36.09	83.33	37.27	82.01	38.41	80.65	39.51	79.25	40.55	77.81	41.55	76.35	42.49	74.85	43.39
8	87.00	33.63	85.80	34.90	84.57	36.13	83.28	37.31	81.96	38.45	80.60	39.54	79.20	40.59	77.77	41.58	76.30	42.53	74.80	43.42
10	86.96	33.67	85.76	34.94	84.52	36.17	83.24	37.35	81.92	38.49	80.55	39.58	79.15	40.62	77.72	41.61	76.25	42.56	74.75	43.45
12	86.92	33.72	85.72	34.98	84.48	36.21	83.20	37.39	81.87	38.53	80.51	39.61	79.11	40.66	77.67	41.65	76.20	42.59	74.70	43.47
14	86.88	33.76	85.68	35.02	84.44	36.25	83.15	37.43	81.83	38.56	80.46	39.65	79.06	40.69	77.62	41.68	76.15	42.62	74.65	43.50
16	86.84	33.80	85.64	35.07	84.40	36.29	83.11	37.47	81.78	38.60	80.41	39.69	79.01	40.72	77.57	41.71	76.10	42.65	74.60	43.53
18	86.80	33.84	85.60	35.11	84.35	36.33	83.07	37.51	81.74	38.64	80.37	39.72	78.96	40.76	77.52	41.74	76.05	42.68	74.55	43.56
20	86.77	33.89	85.56	33.15	84.31	36.37	83.02	37.54	81.69	38.67	80.32	39.76	78.92	40.79	77.48	41.77	76.00	42.71	74.49	43.59
22	86.73	33.93	85.52	35.19	84.27	36.41	82.98	37.58	81.65	38.71	80.28	39.79	78.87	40.82	77.42	41.81	75.95	42.74	74.44	43.62
24	86.69	33.97	85.48	35.23	84.23	36.45	82.93	37.62	81.60	38.75	80.23	39.83	78.82	40.86	77.38	41.84	75.90	42.77	74.39	43.65
26	86.65	34.01	85.44	35.27	84.18	36.49	82.89	37.66	81.56	38.78	80.18	39.86	78.77	40.89	77.33	41.87	75.85	42.80	74.34	43.67
28	86.61	34.06	85.40	35.31	84.14	36.53	82.85	37.70	81.51	38.82	80.14	39.90	78.73	40.92	77.28	41.90	75.80	42.83	74.29	43.70
30	86.57	34.10	85.36	35.36	84.10	36.57	82.80	37.74	81.47	38.86	80.09	39.93	78.68	40.96	77.23	41.93	75.75	42.86	74.24	43.73
32	86.53	34.14	85.31	35.40	84.06	36.61	82.76	37.77	81.42	38.89	80.04	39.97	78.63	49.99	77.18	41.97	75.70	42.89	74.19	43.76
34	86.49	34.18	85.27	35.44	84.01	36.65	82.72	37.81	81.38	38.93	80.00	40.00	78.58	41.02	77.13	42.00	75.65	42.92	74.14	43.79
36	86.45	34.23	85.23	35.48	83.97	36.69	82.67	37.85	81.33	38.97	79.95	40.04	78.54	41.06	77.09	42.03	75.60	42.95	74.09	43.82
38	86.41	34.27	85.19	35.52	83.93	36.73	82.63	37.89	81.28	39.00	79.90	40.07	78.49	41.09	77.04	42.06	75.55	42.98	74.04	43.84
40	86.37	34.31	85.15	35.56	83.89	36.77	82.58	37.93	81.24	39.04	79.86	40.11	78.44	41.12	76.99	42.09	75.50	43.01	73.99	43.87
42	86.33	34.35	85.11	35.60	83.84	36.80	82.54	37.96	81.19	39.08	79.81	40.14	78.39	41.16	76.94	42.12	75.45	43.04	73.93	43.90
44	86.29	34.40	85.07	35.64	83.80	36.84	82.49	38.00	81.15	39.11	79.76	40.18	78.34	41.19	76.89	42.15	75.40	43.07	73.88	43.93
46	86.25	34.44	85.02	35.68	83.76	36.88	82.45	38.04	81.10	39.15	79.72	40.21	78.30	41.22	76.84	42.19	75.35	43.10	73.83	43.95
48	86.21	34.48	84.98	35.72	83.72	36.92	82.41	38.08	81.06	39.18	79.67	40.24	78.25	41.26	76.79	42.22	75.30	43.13	73.78	43.98
50	86.17	34.52	84.94	35.76	83.67	36.96	82.36	38.11	81.01	39.22	79.62	40.28	78.20	41.29	76.74	42.25	75.25	43.16	73.73	44.01
52	86.13	34.57	84.90	35.80	83.63	37.00	82.32	38.15	80.97	39.26	79.58	40.31	78.15	41.32	76.69	42.28	75.20	43.18	73.68	44.04
54	86.09	34.61	84.86	35.85	83.59	37.04	82.27	38.19	80.92	39.29	79.53	40.35	78.10	41.35	76.64	42.31	75.15	43.21	73.63	44.07
56	86.05	34.65	84.82	35.89	83.54	37.08	82.23	38.23	80.87	39.33	79.48	40.38	78.06	41.39	76.59	42.34	75.10	43.24	73.58	44.09
58	86.01	34.69	84.77	35.93	83.50	37.12	82.18	38.26	80.83	39.36	79.44	40.42	78.01	41.42	76.55	42.37	75.05	43.27	73.52	44.12
c=0.75	0.70	0.27	0.69	0.29	0.69	0.30	0.68	0.31	0.68	0.32	0.67	0.33	0.66	0.35	0.66	0.36	0.65	0.37	0.65	0.38
c=1.00	0.93	0.37	0.92	0.38	0.92	0.40	0.91	0.41	0.90	0.43	0.89	0.45	0.89	0.46	0.88	0.48	0.87	0.49	0.86	0.51
c=1.25	1.16	0.46	1.15	0.48	1.15	0.50	1.14	0.52	1.13	0.54	1.12	0.56	1.11	0.58	1.10	0.60	1.09	0.62	1.08	0.64

ENGINEERING NEWS

Founded 1874.

Published Every Thursday. Price, $5.00 a Year.

The past volumes of *Engineering News* constitute an encyclopedia of American engineering practice and public works' construction that has no rival. It has the advantage over the ordinary ponderous reference book issued by some publisher once in a decade or two, in that its contents are always fresh and up-to-date, and if errors occur, they are promptly criticized and corrected.

There is no engineer so thoroughly equipped intellectually and practically that he cannot at times add to his knowledge from the pages of *Engineering News;* to the young engineer just struggling "for place" in his profession, and to the engineering student, there can be no agency more helpful than the weekly installment of this journal.

The
Engineering News Publishing Company
220 BROADWAY, NEW YORK

ENGINEERING NEWS
BOOK DEPARTMENT

PUBLISHES a number of standard technical works by recognized authorities, a selection of which should be on the shelves of every engineer.

This department is prepared to supply, on receipt of advertised prices, any works issued by other publishing houses, and also to give information regarding the best books on special subjects, the equipment of technical libraries, etc. It does not matter whether you are or are not a subscriber for ENGINEERING NEWS, this Department is at your service. Write for catalogue and state subjects in which you are interested.

The
Engineering News Book Department
220 BROADWAY, NEW YORK

A SELECTION OF STANDARD AND USEFUL BOOKS

Send for Complete Catalogue

Field Practice of Railway Location—Beahan	$3.00
Reinforced Concrete—Buel and Hill	5.00
Plat and Profile Book—Dunham	1.00
Concrete Blocks: Their Manufacture and Use	1.50
Universal Dictionary of Mechanical Drawing—Follows	1.00
Railway Right of Way Surveying—Frye	1.00
Index to Engineering News (1890-1899)	.50
Index to Engineering News (1900-1904)	2.00
Earthwork and Its Cost—Gillette	2.00
Economics of Road Construction—Gillette	1.00
Textbook of Plain Lettering—Jacoby	3.00
Engineering Contracts and Specifications—Johnson	3.00
City Roads and Pavements—Judson	2.00
Design of Steel Mill Buildings—Ketchum	4.00
Design of Walls and Bins—Ketchum	4.00
Hydrographic Surveying—Lea	2.00
Surveying Manual—Pence and Ketchum	2.00
Technic of Mechanical Drawing—Reinhardt	1.00
Lettering for Draftsmen, etc.—Reinhardt	1.00
Tables of Logarithims and Squares—Smoley	3.00
Modern Tunnel Practice—Stauffer	3.50
Bridge and Structural Design—Thomson	2.00
Railway Track and Trackwork—Tratman	3.00
Specifications and Contracts—Waddell and Wait	1.00
Linear Drawing and Lettering—Fish	1.00
Hydraulic Diagrams—Swan and Horton	1.00

Civil Service Manuals—Send for Price List.

LIBRARY OF THE UNIVERSITY OF CALIFORNIA

ENGINEERING NEWS
A SELECTION OF STANDARD
AND USEFUL BOOKS
Send for Complete Catalogue

Field Practice of Railway Location—Beahan.. ... $3.00
Reinforced Concrete—Buel and Hill.. 3.00
Plat and Profile Book—Dunham.. 1.00
Concrete Blocks: Their Manufacture and Use.. 1.50
Universal Dictionary of Mechanical Drawing—
Follows.. 1.00
Railway Right of Way Surveying—Frye.. 1.00
Index to Engineering News (1880-1899) .50
Index to Engineering News (1900-1901).. 2.00
Earthwork and Its Cost—Gillette.. 2.00
Economics of Road Construction—Gillette.. 1.00
Textbook of Plain Lettering—Jacoby.. 3.00
Engineering Contracts and Specifications—Johnson. 3.00
City Roads and Pavements—Judson.. 2.00
Design of Steel Mill Buildings—Ketchum.. 4.00
Design of Walls and Bins—Ketchum.. 4.00
Hydrographic Surveying—Lea.. 3.00
Surveying Manual—Fence and Ketchum.. 2.00
Technic of Mechanical Drawing—Reinhardt.. 1.00
Lettering for Draftsmen, etc.—Reinhardt.. 1.00
Tables of Logarithms and Squares—Smoley.. 3.00
Modern Tunnel Practice—Stauffer.. 3.50
Bridge and Structural Design—Thomson.. 2.00
Railway Track and Trackwork—Trautman.. 3.00
Specifications and Contracts—Waddell and Wait.. 1.00
Linear Drawing and Lettering—Fish.. 1.00
Hydraulic Diagrams—Swan and Horton.. 1.00
Civil Service Manuals—Send for Price List.

Engineering News Book Department
220 BROADWAY, NEW YORK

UNIVERSITY OF CALIFORNIA LIBRARY

THIS BOOK IS DUE ON THE LAST DATE
STAMPED BELOW

JAN 29 1916

DEC 16 1916

APR 22 1947

30m-1,'15

YB 51922